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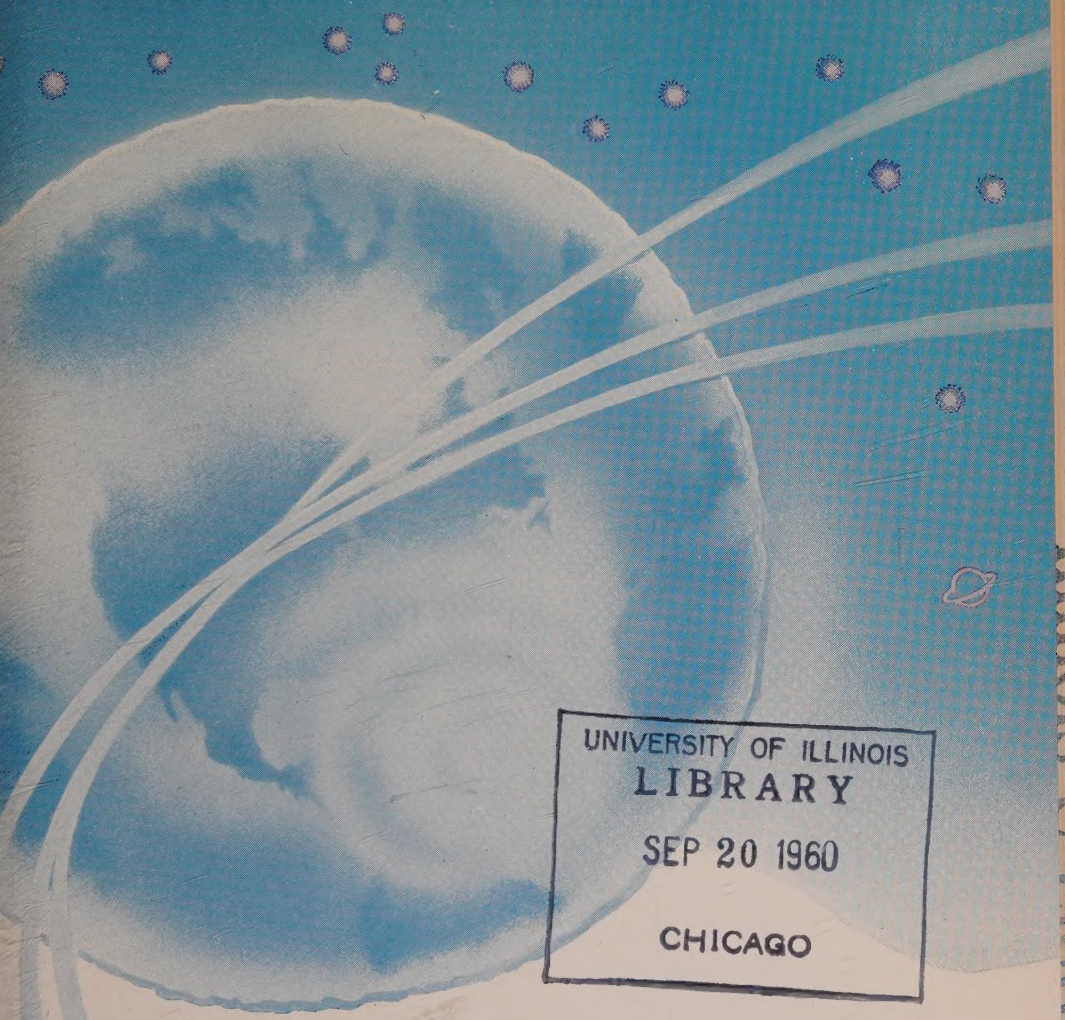

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Vol. 11 MARCH 1960 No. 3

METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS

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METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS

MALCOLM RIGBY, Editor

Vol. 11 MARCH 1960 No. 3

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SPECIAL FEATURE IN THIS ISSUE

Bibliography on Numerical Forecasting (2d Suppl.)
By
Geza Thuronyi

(For table of contents see back cover)

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FOREWORD

Meteorological and Geoastrophysical Abstracts is a monthly publication whose purpose is to bring to the attention of meteorologists, geophysicists and astrophysicists current literature in their field.

Part I contains abstracts of current literature in the fields of meteorology, etc.

Part II of each issue comprises an annotated bibliography of important references on a special subject (usually arranged chronologically).

Bibliographies published in the successive issues were:

Vol. I, 1950

1. Atmos. Pollution	2. Aerobiology	3. Cloud Physics	4. Hail
5. Tornadoes	6. Volcanic Dust	7. Climat. Changes	8. Thunderstorms
9. Icing	10. Acoust. Propagation	11. Evaporation	

Vol. II, 1951

1. Extended Forecast.	2. Long Range Forecast.	3. Soil Temp.	4. Constants, etc.
5. Clim. of Near East	6. Clim. of Middle East	7. Special Winds	8. Radar Storm
9. Condensation Trails	10. Clim. of N. E. Africa	11. Mountain Met.	Detect.

Vol. III, 1952

1. Clim. of N. W. Africa	2. Carbon Dioxide	3. Clim. of Argentina, etc.	4. Dew
5. Objective Forecast.	6. Stratus Forecast.	7. Urban Climatology	8. Clim. of C. Africa
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Vol. IV, 1953

1. Turbulence Theory	2. Turbulent Diffusion	3. Frost	4. Clim. of Australia, etc.
5. High Level Winds	6. Winds in Stratosphere	7. Jet Stream	8. Radiation Bioclim.
9. Clim. of Pacific	10. Auroras	11. Sferics	

Vol. V. 1954

1. Oceanog. Met.	2. Clim. of S. E. Asia	3. Auroral Physics	4. Tropopause
5. Balloons	6. Numerical Forecast.	7. Radiation Data	8. Vertical Motion
9. Clim. of Arctic	10. Industrial Met.	11. Wind Waves and Swell	

Vol. VI, 1955

1. Bibliog. of Bibliog.	2. Texts & Monogr. Bibliogs.		3. Storm Surges
4. Ionospheric Prop.	5. Photochem.—Upper Atmos.		6. Cloud Physics
7. Radar Cloud Physics	8–9. Atmos. Nuclei	10. Weather Modification	11. Cooling Power

Vol. VII, 1956

1. Synoptic Met.-Arctic	2. Clim. of Enclosed Spaces	3. Cosmic Rays (–1952)
4. Cosmic Rays (1953–56)	5. Atmos. Radioactivity	6. Inversions
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Vol. VIII, 1957

1. Solar Weather Relations	2. Night Airglow	3. Forecasting Special Elements
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7. Albedo 8. Meteors	9–10. Tropospheric Prop.	11. Medical Meteorology

Vol. IX, 1958

1. Radioastronomy	2. Solar Astrophysics	3. Radioactivity in Atmosphere
4. Waves and Currents	5. Physical Oceanog.	6. Dynamic & Phys. Oceanog.
7. Long Range Forecast.	8. Radar Met. 9. Cosmic Rays	10–11. Geomagnetism

Vol. X, 1959

1. Works of C. E. P. Brooks	2. Tornado Forecasting	3. Soil Moisture	4. Sferics
5–6. Ozone	7. Acoustic Waves	8. Evaporation Measurement	
9. Evapotranspiration (–1955)	10. Evapotranspiration (1956–1959)	11. Evaporation	

Vol. XI, 1960

1. Outstanding Reference Works 2. Outstanding Texts 3. Numerical Forecast. (2d Suppl.)

Other bibliographies in preparation are:

Forecast Verification	*Ionospheric Physics*	*Radar Meteorology*
High Atmosphere Temperatures	*Ionospheric Propagation*	*Rocket Meteorology*

Part III contains a listing of reviews, translations, reprints, and the contents of important publications. These are published in the earliest issue where space permits.

Part IV is made up of author, subject and geographical indexes. The December issue comprises cumulative author, subject, geographical and journal indexes.

EXPLANATIONS

Location of material: For each entry, a symbol is given for at least one library where th material may be found. The Union List of Serials (Gregory) is the source of most of th symbols used. In some cases, where no symbol has been assigned to a library, one will b devised according to the principles of the Union List.

Library symbols used frequently may be found in the following list:

DA:	U. S. Dept. of Agriculture Library, Washington, D. C.
DBS:	U. S. Bureau of Standards Library, Washington, D. C.
DGS:	U. S. Geological Survey Library, Washington, D. C.
DLC:	Library of Congress, Washington, D. C.
DN-HO:	U. S. Navy Hydrographic Office Library, Suitland, Md.
DNLM:	U. S. National Library of Medicine, Washington, D. C.
DWB:	U. S. Weather Bureau Library, Washington, D. C.

Other symbols:

*	before an entry indicates a good data source.
†	before an entry indicates a good bibliography.
§	before an entry indicates a synoptic case history study accompanied by chart
Ⓢ	after an abstract indicates an abstract prepared for NASA.

Geographic locations are in the English form rather than the form used locally, for exampl Moscow for Moskva.

Titles of articles or monographs are in the language of the original article unless otherwis stated. Slavic (Cyrillic) titles are transliterated into the Roman alphabet using a modifica tion of the Library of Congress transliteration scheme.

Abbreviations:

Titles of periodicals are not abbreviated, as a rule.

The months of the year from March to July are not abbreviated. Other months a abbreviated as Jan., Feb., Aug., Sept., Oct., Nov., and Dec.

The word or abbreviation for Volume (Tom, Band, Jahrgang, Año, etc.), for Numb (Heft, Fascicule, Vypusk, etc.) and for page or pages is omitted from most entries. Thus a entry will read as follows:

Meteorologische Rundschau, 2(5/6):146–151, May/June 1950.

This indicates that the article appeared in *Meteorologische Rundschau*, *Jahrgang* 2 (Vo 2), *Heft* 5/6 (No. 5/6), *pages* 146–151, May/June 1950.

PART I. ABSTRACTS OF CURRENT MATERIAL ON FORECASTING

Note: This issue is devoted in its entirety to publication of a large block of important material on synoptic, objective, and numerical forecasting which has accumulated in the files of *Meteorological Abstracts*. The material on numerical forecasting is organized into a special bibliography in Part II. The material on other aspects of forecasting is arranged according to the categories provided by the Universal Decimal Classification System as indicated in the Outline of Contents on Cover 3. In the April 1960 issue a new outline will be followed, giving more emphasis to the various fields of Geophysics, Astrophysics and, of course, the usual branches of Meteorology.

GENERAL FORECASTING

11.3–1 551.509

Boyden, C. J. (*Forecasting Div., Met. Office*), **The process of forecasting.** *Marine Observer*, London, 28(182):204–206, Oct. **1958.** 4 photos. **DLC**—"The purpose of this article is to explain broadly how the interval between observation and forecast is accounted for and why it cannot be appreciably shorter." *Subject Heading:* **1. Weather forecasting.**

11.3–2 551.509 551.501.9(98)

Fletcher, Robert D. (*Scientific Services, Air Wea. Service, U. S. A. F., Wash., D. C.*), **Arctic weather-forecasting problems of the Air Weather Service.** (In: Polar Atmosphere Symposium, Oslo, July 2–8, 1956, **Proceedings, Pt. 1, Meteorology Section.** N. Y., Pergamon Press, **1958.** p. 118–123.) Also issued in *Journal of Atmospheric and Terrestrial Physics*, London, Special Supplement, Pt. 1, **1957,** pub. **1958.** p. 118–123. **DWB, DLC**—The problems of which some are discussed here are, first of all, of a logistic nature, involving manpower, instrumentation, provisions and maintenance of the remote weather stations. There are 17 upper air stations in the Western Hemisphere north of the Arctic circle, or 230,000 sq mi of area per station, or a ratio 5:1 in favor of U. S. distribution. The supply lines involve forecasting problems for aviation of which one is middle-cloud forecasting (10,000–20,000 ft). Solution of the problem is lagging mainly because of inadequate humidity measurements at low temperatures. Local terminal prediction of ceiling, visibility and strong surface wind is another problem along the fog, ice-fog, maximum and minimum temperature and influence of local terrain on precipitation. The third problem is that of upper air winds. Here, KOCHANSKI'S results of recent studies of wind and temperature soundings (700 to 5 mb) are summarized and found valuable. D. E. MARTIN'S method as applied to forecasting is exemplified. Arctic meteorological problems are, to a great extent, dependent for solution on cooperation and free exchange of ideas and information. *Subject Headings:* **1. Arctic weather stations 2. Arctic weather forecasting 3. Upper air winds 4. Arctic.**—*W.N.*

11.3–3 551.509(213)

Thompson, B. W., **Some reflections on equatorial and tropical forecasting.** *East Africa High Commission. Meteorological Dept., Technical Memorandum*, No. 7, **1957.** 14 p. 15 refs. **DWB**—The evolution of the concept of the Intertropical Convergence Zone from the more elementary and less realistic Intertropical Front hypothesis that prevailed before and even during World War II, is traced. The latter is evident during the summer solstice over India, West Africa and the Sahara, but not in most other areas. Particular stress is placed on the East Africa monsoon and associated rainfall and humidity (aloft) conditions. ASPLIDEN has an unpublished theory of waves induced in upper troposphere easterlies or westerlies to explain rainfall. A cheap humidity radiosonde is suggested for use in tropics. Upper air conditions are considered more important than surface conditions, since no systematic wind

or pressure movements can be traced across country, except in post analyses. *Subject Headings:* **1. Tropical weather forecasting 2. Intertropical Convergence Zone 3. East Africa.**—*M.R.*

11.3–4 551.509.1:551.509.5:621.396

Dady, Guy, **La théorie de l'information dans les problèmes météorologiques.** [The information theory in meteorological problems.] *Journal Scientifique de la Météorologie*, Paris, 10(39):121–131, July/Sept. **1958.** 2 figs., 11 refs., eqs. French, English and Spanish summaries p. 121. **DWB**—Information theory finds a natural application in meteorological problems. After a few classic definitions and results, the author shows how aspects of that theory can be introduced into the problem of coding observations for transmission and storage for continuous meteorological fields in the memory of computers. Moreover, he indicates how quantitative information allows estimation of the quality of a meteorological element forecast without formulating hypotheses on the relation between the forecasted and the observed element. *Subject Headings:* **1. Information theory 2. Coding methods 3. Data transmission 4. Forecast verification.**—*Author's abstract.*

PROGNOSTIC CHARTS

11.3–5 551.509.25

§Di Benedetto, Felice, **Il metodo di Scherhag per la costruzione della carta generale prevista per 24 ore.** [Scherhag's method for constructing a 24-hour prognostic chart.] *Rivista di Meteorologia Aeronautica*, 13(1):16–25, Jan./March **1953.** 6 figs. French, German and English summaries p. 16. **DWB**—A detailed description and example of the analysis and projection which is necessary in preparing 24 hour prognostic charts on the basis of SCHERHAG's rules and techniques. Twelve steps involved in this isallobaric analysis are enumerated and 6 charts presented. The method is based on the ideas of BJERKNES and PALMÉN regarding the controlling influence of the upper troposphere on the pressure changes in the stratosphere and at the surface. Eleven rules-of-thumb regarding effects of convergence vertically and horizontally in the upper troposphere are presented. *Subject Headings:* **1. Prognostic chart preparation 2. Scherhag's method of analysis.**—*M.R.*

11.3–6 551.509.25:551.509.317

†Vederman, Joseph and Dubofsky, Bernard (*both, Natl. Wea. Analysis Center, U. S. W. B., Wash., D. C.*), **An operational technique for the forecasting of flow patterns in the upper troposphere.** *American Meteorological Society, Bulletin*, 40(5):233–239, May **1959.** 10 figs., table, 17 refs. **DWB, DLC**—Forecasting procedures are given so that a rapid 300 mb or 200 mb prognostic chart can be made from any valid 500 mb prognosis. Height relationships are given between the 500 and 300 mb levels and the 500 and 200 mb levels. The 500 mb relative vorticity is also utilized to adjust for variations in tropopause height. *Subject Headings:* **1. Prognostic charts 2. Forecasting for 200 mb level 3. Forecasting for 300 mb level 4. Tropopause height.**—*Authors' abstract.*

11.3–7 551,509.25(5–012):551.509.334

Zverev, N. I., **Analiz tsirkuliatsionnykh usloviĭ na Dal'nem Vostoke i opyt ispol'zovaniia ikh pri prognoze karty AT_{500} na 3—5 dneĭ.** [Analysis of circulation conditions over the Far East and an attempt of their use in forecasting 500 mb charts for 3–5 days.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 64:61–86, **1958.** 6 figs., 12 tables, 8 refs., 32 eqs. **DLC**—An attempt is made to establish an objective and operational method of forecasting 500 mb charts 3–5 days in advance for the conditions prevailing in the Far East. The model of the atmospheric circulation used in this analysis was characterized by cyclones and anticyclones aloft, troughs and ridges which moved in the course of three days with southeasterly components without altering their intensity and the velocity characteristic of the given locality. The evolution of the pressure formation occurred under the influence of the meridional monsoon circulation and transformation of air by the underlying surface. A detailed analysis is given of the atmospheric circulation in the Far East including mean monthly velocity of the zonal transport, 24 hr displacement of troughs and ridges aloft, the velocity of displacement of cy-

clones and anticyclones aloft at 500 mb and the conditions under which they become stationary, meridional transport of air under the conditions of the Far East, and transformation of air. This is followed by the development of an approximate method of forecasting 500 mb charts 3–5 days in advance for May, June, July and August under the conditions of the Far East and Eastern Siberia. *Subject Headings:* **1. Synoptic patterns 2. Extended forecasting 3. Prognostic chart preparation 4. Far East.**—*I.L.D.*

FORECASTING METHODS

11.3–8 551.509.3

Mori, Y., **Forecasting of weather tendency.** *Journal of Meteorological Research*, Tokyo, 4(9):595–599, Feb. **1953.** 7 figs., table. In Japanese; English summary p. (37).—The curve obtained by plotting the difference between pressure of the day and the mean pressure of the past 5 days has the property that its period corresponds to one of the weather change periods. This curve can be analyzed by a special method developed in this paper. *Subject Heading:* **1. Forecasting techniques.**—*Author's abstract.*

11.3–9 551.509.31(74,75)

§Schrott, R., **Study of average maps as an aid to analysis and forecasting.** *Weather Radar Conference, Sept. 1955, Proceedings of the Fifth . . . Conference*, p. 73–78, pub. **1956.** 4 figs. **DWB**—Primary waves can be identified by averaging over intervals of three or five hrs. In the eastern United States hourly weather maps have been used and analyzed in great detail. Sample hourly charts as well as charts of surface pressure in eastern United States are given. *Subject Headings:* **1. Synoptic analysis 2. Eastern United States.**—*N.N.*

11.3–10 551.509.31

Shafer, R. J.; Bailey, R. E. and Hilworth, J. T., **Further studies in the development of short-range weather prediction techniques.** Eastern Air Lines, Inc. Meteorology Dept., Atlanta, Contract AF 19(604)-2073, Scientific Report, No. 1, April **1958.** 171 p. 122 figs., 4 tables, 23 refs. **DWB** (M09.318 E13sc)—Articles abstracted separately. *Subject Heading:* **1. Short range forecasting.**

11.3–11 551.509.31:551.557.2

§Shishkova, I. A., **K voprosu o prognoze traektoriĭ vozdushnykh chastits.** [The problem of predicting the trajectories of air particles.] *Meteorologiia i Gidrologiia*, Leningrad, No. 4:8–14, April **1958.** 5 figs., 2 tables, 3 refs., 3 eqs. **DWB, DLC**—The quality of forecasts of temperature, cloudiness, thunderstorms, advective fogs, etc. depends upon the proper construction of predictable trajectories of atmospheric particles. In this paper, the author presents a method for construction of 12-hour predicted trajectories (more exactly their horizontal projections) from a given initial contour chart, on the basis of yields of local acceleration, which are computed by the equations:

$$\frac{\partial u}{\partial t} = l\left(-\frac{1}{l}\frac{\partial H}{\partial x} + v\right) - \frac{1}{l^2}\left(\frac{\partial H}{\partial y}\frac{\partial^2 H}{\partial x \partial y} - \frac{\partial H}{\partial x}\frac{\partial^2 H}{\partial y^2}\right)$$

and

$$\frac{\partial v}{\partial t} = -l\left(\frac{1}{l}\frac{\partial H}{\partial y} + u\right) + \frac{1}{l^2}\left(\frac{\partial H}{\partial y}\frac{\partial^2 H}{\partial x^2} - \frac{\partial H}{\partial x}\frac{\partial^2 H}{\partial x \partial y}\right)$$

where l = Coriolis parameter, H = geopotential, u and v = constituent wind velocities along the X and Y axes. The constituent local velocities depend upon the nongeostrophic deviations (first terms on right) and upon terms depending upon the curvature of isohypses (second term on the right). In computing the trajectories, local velocities were considered constant for 12 hrs but were averaged along the paths of motion of the particles according to 6-hr intervals, so that the changes of sign could be taken into account. The 12-hr forecast trajectories were made in directions opposite to the wind vector at the point examined and the rotation of the wind with time was taken into account. The comparison of computed trajectories with

simplified means of extrapolation with actual trajectories indicates the superiority of calcula tions that take into consideration local acceleration in the first 12 hrs and in subsequent 6-h movement of particles. The results of comparison of computed and actual trajectories ar presented in tables and on synoptic maps. *Subject Heading:* **1. Air trajectory forecasting** —*I.L.D.*

11.3–12 551.509.31:551.515.11(4–015)

§U. S. Navy Weather Research Facility, **An aid to forecasting weather in the Mediterranean Sea: a research report on Task 13.** Its [*Pub.*] *NWRF* 13-0758-012, Sept. **1958.** 42 p charts, 3 refs.—A brief review and some new data are given on the problem of forecasting cyclogenesis in the Mediterranean. A prediction method is devised for forecasting repeated cyclogenesis using the appearance of new minor troughs and the characteristics of the current at the inflection point in the major northwest current. Three techniques are presented for predicting the 24-hr movement of cyclones in this area, each one having its own class of synoptic cases for which it should be used. One of these techniques simply uses a measure of wind speed and direction in a given area at 500 mb above the surface low center. The other two have to do with the movement and characteristics of the northwest or northerly current at the point of inflection. A general method of predicting good or bad weather in the area is developed and described using the orientation, speed and fetch of major 500 mb currents. A general synoptic climatology for the Mediterranean is presented. *Subject Headings:* **1. Cyclogenesis forecasting 2. Synoptic climatology 3. Mediterranean region.**—*Author's abstract.*

11.3–13 551.509.311:551.515.8(47)

§Popova, T. P., **Analiz uslovii evoliutsii teplykh frontov nad Evropeĭskoĭ territorieĭ SSSR v kholodnoe vremia goda.** [Analysis of conditions for the development of warm fronts over European U.S.S.R. during the cold part of the year.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy,* No. 60:80–95, **1957.** 8 figs., 3 tables, 8 refs., 8 eqs. **DWB** (M(055) U581tts)— The characteristic property of the evolution of warm fronts over European U.S.S.R. in winter is the increase in the width of the prefrontal precipitation zone. Observational data for the winters of 1950–1953 showed that in 67% of the cases the zone of prefrontal precipitation increased in warm fronts; the zone decreased in the case of fronts coming from the south. All warm fronts moving in winter across European U.S.S.R. have the following characteristics: the temperature of the warm air in the frontal zone usually diminishes with altitude; the temperature of cold air at the earth's surface and at the 850 mb surface also diminishes, except at 700 mb where it occasionally rises. The moisture content of the frontal zone at the earth usually decreases both in a warm and cold front; at 1.5 km the moisture content of cold air usually declines also, but it may increase in the case of a warm front. The variation of the stratification of warm air behind a front and trajectories of warm and cold fronts are discussed with the aid of tephigrams and maps. The transformation of warm air under the influence of the underlying surface, the dependence of the phase condition of precipitation upon stratification in the layer near the ground, and the influence of vertical air motions upon the evolution of a warm front are analyzed with the aid of relevant equations of vertical turbulent heat flow and frontogenesis. *Subject Headings:* **1. Warm front structure 2. Frontal development 3. Synoptic studies 4. European U.S.S.R.**—*I.L.D.*

11.3–14 551.509.311:551.515.8(47

§Popova, T. P., **Osobennosti teplykh frontov nad Evropeĭskoĭ territorieĭ SSSR zimoĭ** [Peculiarities of warm fronts over European U.S.S.R. in winter.] *Meteorologiia i Gidrologiia* Leningrad, No. 6:12–20, June **1957.** 7 figs., 2 tables. **DWB.** Transl. into English by Geraldine Kline, ed. by David Kraus, issued by American Meteorological Society under Contract AF 19(604)-1936. 12 p. 7 figs., 2 tables.—Quantitative characteristics of fronts were studied on the basis of extensive material of winter warm fronts over European U.S.S.R. 63 cross sections were constructed from 429 airplane and radiosonde soundings. In the lowe 2–3 km the warm front can be followed clearly in most cases. Above this height the front is a transitional layer between cold and warm air with less distinct boundaries. At higher elevations the vertical temperature gradient in the frontal gradient is less than at lower elevations. At the surface of the earth the longitudinal extension of a front is between 100 and 200 km

aloft it is between 400 and 500 km. The vertical thickness of a warm front varies from 1000 to 3000 m. The examples of warm fronts are analyzed in detail. Vertical cross sections of these examples are shown. Also data are presented on the vertical temperature gradient and the gradient of specific humidity as illustrated in vertical cross sections of warm fronts. *Subject Headings:* **1. Warm front structure 2. Frontal development 3. Synoptic studies 4. European U.S.S.R. I. Kline, G.** (*transl.*).—*I.L.D.*

11.3–15 551.509.311:551.524.7:551.510.52/3

§Zubian, G. D., **Issledovanie prostranstvennoĭ modeli fronta, okhvatyvaiushcheĭ vsiu troposferu i nizhniuiu stratosferu.** [Investigations on a spatial frontal model embracing the entire troposphere and the lower stratosphere.] *Meteorologiia i Gidrologiia*, Leningrad, No. 5:3–11, May **1957.** 7 figs., 2 refs. **DWB.** Transl. into English by Geraldine Kline (ed. by David Kraus), issued by American Meteorological Society under Contract AF 19(604)-1936, Nov. **1958.** 10 p.—For analyzing and forecasting large variations in temperature in the upper atmosphere and lower stratosphere and oscillations of the tropopause, the author developed a spatial frontal model (*Met. i Gid.* No. 9:12–21, **1956**; *see* 10.10–240, Oct. 1959, *MAB*). In this article the author examines the development of synoptic processes from May 19–27, 1955 in a frontal zone that extended from Aleksandrovst (extreme east of the U.S.S.R.) to Rome. Vertical atmospheric sections show that the spatial unity of tropospheric and stratospheric frontal zone was never disrupted during this entire period. The entire frontal systems maintained the qualitative properties of temperature and wind fields and the position of the tropopause relative to the frontal systems. Accordingly the study of such a spatial model can be used in synoptic analysis and forecasting changes in temperature in the upper layer and the oscillations of the tropopause. *Subject Headings:* **1. Spatial frontal model 2. Stratospheric temperature forecasting 3. Tropospheric temperature forecasting 4. Tropopause oscillations 5. Upper air temperature variations.**—*I.L.D.*

NUMERICAL FORECASTING

See: special bibliography, p. 415.

KINEMATICS

11.3–16 551.509.312:551.558.2

Burtsev, A. I., **Ob uchete izmeneniia vertikal'noĭ skorosti s vysotoĭ pri raschete adiabaticheskikh izmeneniĭ temperatury.** [Computing changes in vertical speed with height in the calculation of adiabatic temperature changes.] *Meteorologiia i Gidrologiia*, Leningrad, No. 7:26–30, July **1957.** fig., 3 tables, 4 refs., 12 eqs. **DWB, DLC**—In existing methods for determining the change in temperature and humidity as a result of vertical movement, the calculated individual pressure change of air particles in a vertical direction is correct only if the vertical velocity varies slightly with height. In this article a method is developed for taking into account, even though approximately, the change of vertical velocity with height during the computation of temperature change with vertical motion. On the assumption that on isobaric surfaces and between isobaric surfaces along a trajectory, τ (i.e. $d\rho/dt$) can be represented in the following manner:

$$\tau = \tau_A + \frac{\gamma u}{L t_1} t + \frac{\alpha + \left(\frac{\beta - \gamma}{L}\right) ut}{t_1 \Delta\beta} (p_1 - p),$$

where t_1, interval of time for which the temperature change is determined; $(\tau_C - \tau_A)t_1 = \alpha$; $(\tau_D - \tau_C)t_1 = \beta$; $(\tau_B - \tau_A) = \gamma$; L = length of curve AB on the isobaric surface; $\Delta p = p_1 - p_2$, pressure on the lower and upper isobaric surface, u = horizontal constituent of wind velocity. The solution of this linear differential equation is presented. An example is given of the calculation of individual change of pressure and the associated adiabatic temperature change

over Leningrad from 6 to 8 o'clock, 8 June 1955, taking into account the change in vertical velocity with height. τ was calculated by the following formula:

$$\tau_1 = -\left[\alpha(\overline{\Delta p})\frac{d\overline{\Delta p}}{dt} + \beta(\overline{\Delta p})\right]$$

Data are presented on the values of τ on the fundamental isobaric surfaces at the beginning and end of the trajectory (in mb/12 hours), values of coefficients $\alpha(\Delta p)$ and $\beta(\Delta p)$ for $h_1 = 1$ km, $l = 1.1 - 10^{-4}$ sec^{-1}, and the results of calculation of adiabatic changes of temperature for Leningrad. It is seen that when the variation of vertical velocity with height is taken into account during the computation of individual pressure changes the computed temperature is within a range of 3–4°C of the actual temperature. *Subject Headings:* **1. Adiabatic temperature changes 2. Vertical velocity with height variations.**—*I.L.D.*

11.3–17 551.509.312:551.558.2

*Curtis, R. C. and Panofsky, H. A. (*both, Pennsylvania State Univ.*), **The relation between large-scale vertical motion and weather in summer.** *American Meteorological Society, Bulletin*, 39(10):521–531, Oct. **1958.** 3 figs., 11 tables, 6 refs. **DWB, DLC**—Large scale vertical velocities are shown to be closely related to the probabilities of convective precipitation and fair weather in the eastern United States during July 1955. In the daytime the mean relative humidity of the 900 to 700 mb layer is better related to the probability of convective precipitation than the vertical velocity. At night, however, vertical velocity is the best single predictor of convective precipitation, with a modified Showalter Index being a very useful additional criterion. The large scale vertical velocities that occur in normal summer synoptic situations appear to be produced by a diurnal variation in the momentum exchange between the ground and the air. *Subject Headings:* **1. Large scale vertical motion 2. Vertical velocity—weather relationships.**—*Authors' abstract.*

11.3–18 551.509.312:551.509.322:681.14:621.3

Djurić, Dušan and Wiin-Nielsen, Aksel, (*Inst. of Met., Univ. of Stockholm, Sweden*), **Preliminary Report on computation of trajectories by means of electronic computers.** *Germany, Deutscher Wetterdienst, Berichte*, 5(38):22–23, **1957.** ref., 3 eqs. Abstract only in English and German. **DWB, DLC**—A method for working out trajectories by means of an electronic computer is summarized. The wind is assumed to be horizontal and determined in every point by the corresponding geopotential field of an isobaric surface. The local change of coordinates (a,b) determining a point in the field is expressed by the formulas $\partial a/\partial t = -v\cdot\nabla a$ and $\partial b/\partial t = -v\cdot\nabla b$. These formulas take the following form

$$\frac{\partial a}{\partial t} = \frac{m^2}{f}j(a,\phi), \qquad \frac{\partial b}{\partial t} = \frac{m^2}{f}j(b\cdot\phi)$$

where f is the Coriolis parameter, ϕ=geopotential and m=map magnification factor. The initial rectangular coordinates and a, b, computed after a certain time are plotted on the same map. At the intersection between the isolines of a and b the final position of the particles is found. The trajectory can be found by connecting initial and final positions of the particle. The determination of the geopotential field in the case of forecasted trajectories and in that of diagnostic trajectories is described. *Subject Headings:* **1. Trajectory forecasting 2. Electronic computers.**—*I.L.D.*

11.3–19 551.509.312:551.547.5:551.515.127

Dydina, L. A., **Sviaz' nazemnogo baricheskogo polia s raspredeleniem ochagov tepla i kholoda v troposfere.** [Connection between the surface pressure field and the distribution of heat and cold centers in the troposphere.] *Meteorologiia i Gidrologiia*, Leningrad, No. 7:32–34, July **1958.** table, 6 refs., eqs. **DWB, DLC**—An examination of the possibility of applying to elementary synoptic forecasts the relationship between the distribution of centers of heat and cold in the troposphere during the initial elementary synoptic process and the distribution of principal pressure fields in the subsequent elementary synoptic process. The tendency of developing pressure systems to be displaced in a particular direction under cor-

responding centers of heat and cold should be expressed not only for the daily forecast but also for the elementary synoptic period. Hence the position of corresponding centers of heat and cold in the troposphere during the initial elementary synoptic period should predetermine in general the movement of pressure systems in the subsequent elementary synoptic period in a given direction. A comparison of the distribution of centers of heat and cold on isobaric 700 and 500 mb surfaces in the initial elementary synoptic period with the distribution of surface pressure fields in the subsequent elementary synoptic period showed that the demarcation line between surface pressure fields of subsequent ESP were very close in position to the demarcation lines between centers of heat and cold at 700 and 500 mb levels of the initial ESP. The coincidence of centers of heat and cold at 700 and 500 mb levels with corresponding cyclonicity and anticyclonicity fields amounted to 70–90% of the cases for each map constructed. Accordingly demarcation lines between heat and cold centers for an initial ESP can be used as an index of demarcation lines between pressure fields for a subsequent elementary synoptic period. The use of this relationship to construct preliminary forecasting schemes for the development of synoptic processes 3–4 days in advance is described. Verification of this relationship gave a value of 65% absolute agreement for the Northern Hemisphere in 1955–1956. A statistical evaluation of 40 forecasts using the formula for two-phase forecast, $H=\frac{u-u_0}{1-u_0}$ (H=criterion of reliability, u_0=verification of random forecasts, u=verification of forecasts by the given method) yielded a value of $H=0.59$, which is considerably higher than the accepted value of 0.2–0.3. *Subject Headings:* **1. Tropospheric heat and cold centers—pressure field relationships 2. Synoptic forecasting.**—*I.L.D.*

11.3–20 551.509.312:551.509.322

Franceschini, Guy A.; Freeman, John C., Jr.; Kasahara, Akira, et al., **Theory of an analysis and prediction of trajectories.** Texas. Agricultural and Mechanical College. Dept. of Oceanography and Meteorology, Contract AF 19(604)-1302, Final Report, Oct. **1958.** 94 p. figs., tables, refs., eqs. Contents: **Method of computing trajectories,** p. 8–21. Todsen, Marius, **Horizontal air trajectories in a geostrophic field with uniform horizontal shear,** p. 22–58. **Theoretical aspect of constant pressure trajectories,** p. 59–63. **Kinematic method of computing balloon trajectories using an electronic calculator,** p. 64–66. **Computations of velocity and acceleration,** p. 67–73. **Local height change,** p. 74–76. **Properties of wind field,** p. 77–83. **Study relating to the use of predicted trajectories: a Lagrangian chart,** p. 84–91. **DWB**—Studies conducted were grouped into the three following categories with objectives as noted: 1) theory of trajectories—directed toward development of prediction methods, 2) analyses of observed trajectories—directed toward determination of operational use of observed balloon flights, 3) use of predicted trajectories—directed toward meteorological use of trajectory predictions. Results in the three categories were obtained. Dynamic and kinematic methods of predicting trajectories were developed which show appreciable improvement over previously existing methods. Results of analyses of observed balloon trajectories indicate this system of observation can furnish valuable meteorological data especially in areas where standard observations are lacking. A trajectory chart, based on predicted trajectories, was devised. Preliminary results presented indicate this chart should find operational use as a prognostic, as well as diagnostic, tool. A theoretical note relating to trajectories, of a preliminary nature, is presented. Also, a theoretical discussion of trajectories in the vicinity of the "jet stream" is given. The latter suggests a possible reason for the existence of isotach centers observed on daily charts. *Subject Headings:* **1. Air trajectory forecasting 2. Balloon trajectories 3. Air trajectory studies.**—*Authors' abstract.*

11.3–21 551.509.312:551.511

Franceschini, Guy A., **Three-dimensional distribution of Lagrangian divergence for selected cases.** Texas. Agricultural and Mechanical College. Dept. of Oceanography and Meteorology, Contract AF 19(604)-2222, Scientific Report, No. 6, Oct. **1958.** 21 p. 20 figs., 5 tables, ref., 6 eqs. **DWB** (M(051) T355sci)—The three-dimensional distribution of Lagrangian divergence for selected pressure systems is presented. Computations of divergence, based on a trajectory method, were made for several pressure surfaces in each case. Vertical patterns were obtained by combining these results. A qualitative discussion is given for the

five cases considered. Results agree with theoretical considerations. Implications are made on the use of trajectory method for determining Lagrangian divergence in connection with analysis and forecasting problems. A summary discussion of the contribution of divergence to pressure changes is given in an appendix. Suggestions are made regarding the consequence of the cellular nature of divergence. *Subject Headings:* **1. Divergence computations 2. Pressure-divergence correlations.**—*Author's abstract.*

11.3–22 551.509.312:551.558.21

Harrison, Henry T. (*Dir. of Meteorology, United Air Lines, Denver, Colo.*), **Forecasting the mountain wave at Denver, Colorado.** *United Air Lines, Inc., Meteorology Circular*, No. 42, Aug. 15, **1957.** 17 p. 11 figs., 23 refs. **DWB** (M:629.13 U58mc)—Graphs and charts showing mean sea level pressure, mean 700, 500 and 300 mb patterns, mean wind speed profile (5000–40,000 ft), position of jet stream and mean upwind sounding for a strong mountain wave case in winter of 1955–6 at Denver are presented, and a nomogram compiled from all cases during July–December 1956 of weak or strong mountain waves based on maximum wind speed at 10,000–18,000 ft, and sea level pressure difference Grand Junction–Denver, showing 91% accuracy in segregating no mountain wave and weak from strong waves. Finally, a scattergram for independent control based on January–June 1957 data shows 89% verification; exceptions to rule are discussed. *Subject Heading:* **1. Lee wave forecasting.**—*M.R.*

11.3–23 551.509.312:551.511

Ito, S., **Dynamical study on the development of trough (Studies on the divergence analysis, Pt. 1).** *Journal of Meteorological Research*, Tokyo, 7(10):609–615, Dec. **1955.** 7 figs., 5 refs., 13 eqs. In Japanese; English summary p. 609. Also his: **A note on the divergence equation.** *Ibid.*, p. 671. 8 eqs. In Japanese. **DWB, DLC**—Assuming quasi-geostrophic approximation, the relative divergence tendency is given by an equation accounting for relative divergence, unit vertical vector, thermal wind velocity vector, thermal vorticity, and Coriolis parameter. In the first article, the dynamic instability of "May Storm," a remarkably developed storm near Hokkaido in May 1955, was analyzed by means of this equation, and the results are as follows: (1) The divergence equation is very helpful in analyzing synoptic charts, (2) The unstable domain obtained from thickness chart (500∼850 mb) seems to be in good agreement with the storm center at 700 mb level, (3) A preliminary explanation of the relation between dynamical effect of thermal wind and development and displacement of storm is given. *Subject Headings:* **1. Divergence analysis 2. Quasigeostrophic approximation 3. Hokkaido, Japan.**—*Author's abstract.*

11.3–24 551.509.312:551.511

Ito, S., **Dynamical study on the development of trough (Studies on the divergence analysis, Pt. 2).** *Journal of Meteorological Research*, Tokyo, 8(7):395–399, Aug. **1956.** 6 figs., 3 refs., 7 eqs. **DWB, DLC**—Assuming quasigeostrophic approximation, the deformation of the atmosphere is computed from the following relation:

$$\theta = \tfrac{1}{2} \tan^{-1} [(Z_1 - Z_3 + Z_5 - Z_7)/-2(Z_2 - Z_4 + Z_6 - Z_8)],$$

$$A_1 \approx [980/f(\delta s)^2] \sqrt{(Z_1 - Z_3 + Z_5 - Z_7)^2 + 4(Z_2 - Z_4 + Z_6 - Z_8)^2},$$

where $Z_i (i = 1, 2, \ldots 8)$ is isobaric height at grid point, f the Coriolis parameter, δs the grid interval, θ the inclination angle of axis of deformation for x axis and A_1 the magnitude of deformation. In this report, the author analyzed a deformation field over the Far East using the above relation, and found that the maximum value of deformation exists near a trough or ridge. *Subject Headings:* **1. Divergence analysis 2. Dynamic instability 3. Quasigeostrophic approximation.**—*Author's abstract.*

11.3–25 551.509.312:551.511

Ito, S., **On the errors of vorticity calculation by balance equation (Studies on the divergence analysis, Pt. 3).** *Journal of Meteorological Research*, Tokyo, 10(8):714–717, Aug. **1958.** table, 21+ eqs. In Japanese. **DLC**—The author develops an expression for absolute molec-

ular and large scale vorticity and divergence from the previous equation in Pt. I and II, which explained in general that in the balance equation of divergence analysis the error was 1/100 though divergence is 1/10 of vorticity in the air. Here the author derives a quadratic equation for the measurement of absolute vorticity. But first; $\frac{dD}{dt} + \frac{1}{2}D^2 - \frac{1}{2}\eta^2 + \frac{1}{2}\eta'^2 = 0$. Divergence Analysis; $\frac{d\eta}{dt} = -\eta D$ Vorticity calculation, therefore, in case of minimum vorticity of divergence; $\frac{\eta ti - \eta' o}{\eta' o} = \frac{1}{2}\sqrt{(1 + 8E/\eta' o^4)} \sin \eta' ot$. $\eta'^2 = \text{Const.}$ Then, in case of maximum vorticity of divergence, its error is;

$$\frac{\eta ti - \eta' o}{\eta' o} = \left[\sqrt{2} \cos\left(\frac{4\sqrt{2}}{10}\eta' oti + \frac{\pi}{4}\right) - 1\right]$$

On the above assumption, the variation of air vorticity is dependent to a certain extent on the inertia movement of its mean is $2\pi/f$ as a whole. *Subject Headings:* **1. Divergence analysis 2. Absolute vorticity.**—*J. Woo.*

11.3–26 551.509.312:551.511:551.543(456.3)

La Valle, Lodovico, **Variazione della pressione al suolo e variazione della temperatura alla varie quote.** [Surface pressure variations and temperature variations at varying elevations.] *Rivista di Meteorologia Aeronautica*, Rome, 17(4):14–24, Oct./Dec. **1957.** 7 figs., 9 eqs. Italian, French, English and German summaries p. 14. **DWB**—Data for 900, 800, 700, 500, 300, 200 and 150 mb at 03 h for 1954 and 1955 at Ciampino are analyzed to show the relation of warm and cold advection to convergence and divergence and the consequent surface pressure resulting from density variations at any height or in any given layer. Theory is given in detail and schematic diagrams used to illustrate effects. Conclusion is that if warm air is present in a layer there is convergence, and if cold air is present there is divergence—these factors may compensate each other in surface pressure. *Subject Headings:* **1. Differential kinematics 2. Pressure changes 3. Warm advection 4. Ciampino, Italy.**—*M.R.*

11.3–27 551.509.312

§Mørch Jensen, Kurt (*Weather Forecasting Dept., Danish Met. Inst.*), **Forecasting of sea-level pressure by advection of sea-level vorticity.** *Geophysica*, Helsinki, 6(1):13–24, **1957.** 6 figs., 9 refs., numerous eqs. **DLC**—A description of a method for preparing a forecast of the sea-level pressure chart or of the 1,000 mb isohypses. The method is rather "geometrical" but nevertheless it is based on a certain amount of knowledge now available on the physics of the weather. It may only be considered as a "basic principle" for routine forecasting. The space mean streamline pattern of the 592 mb level is used as a steering field and the sea-level vorticity is selected as object of prognostication. By the aid of the observed pressure tendencies the vorticity is corrected for "development," and then displaced in the steering field. *Subject Headings:* **1. Pressure forecasting 2. Sea level vorticity.**—*Author's abstract.*

11.3–28 551.509.312:551.509.317

Reuter, Heinz and Huber, Franz, **Über den Anteil verschiedener Höhenschichten am Zustandekommen von Bodendruckänderungen.** [The role of various upper layers in the origin of pressure changes near the ground.] *Germany. Deutscher Wetterdienst, Berichte*, 4(22):108, **1956.** 2 figs., 2 eqs. **DWB, DLC**—Using the equation

$$\frac{dpo}{dt} \cong \eta_0 \int_{po}^{0} \left(\frac{\partial(1/\eta)}{dt} + v_2 + \nabla\frac{1}{\eta}\right) d_p;\ \eta \equiv rotpv + f,$$

the author constructed the reciprocal vorticity distribution at 850, 700, 500, 225 and 95 mb for the weather situation of Jan. 1–2, 1950 and determined the local change and advection during a 24-hr period. The purpose of this study was to predict the behavior of the integral in the above equation within a p-surface and in different height levels. Two cases are illustrated graphically, one shows the extensive mutual compensation within a p-surface (225

and 500 mb) area in the vertical (above and below a 500 mb surface). *Subject Heading* **1. Upper air vorticity forecasting.**—*I.L.D.*

11.3–29 551.509.31

Sarymsakov, T. A., **Tsepnye protessy i problema prognozov pogody.** [Chain processe and weather forecasting problems.] (In: Akademiia Nauk Uzbekskoĭ SSR. Institut Mate matiki i Mekhaniki, **Meteorologiia i gidrologiia v Uzbekistane.** Tashkent, **1955.** p. 93–101 fig., 3 tables, ref.) **DLC**—The author surveys a number of studies indicating the possibility of utilizing the fundamental ideas of chain processes of the Markov type in synoptic meteor ology in order to establish the existence of laws in atmospheric processes, the use of these law in studies on the formation of the weather and climate of a region. The development o synoptic processes is regarded as random processes of the Markov type. The particular case when the evolution of a system is regarded as forming a discrete sequence in individual moments of time and when the possible number of conditions of the system is finite corresponds to a Markov chain. The application of these chains to the statistical characteristics of the types of synoptic conditions forming the weather over Central Asia and the Near East and to the analysis of the temperature anomalies in Tashkent, the formation of weather in Central Asia and the influence of the quasi-stationary anticyclone over North Africa, the circulation in Central Asia and the Near East is illustrated by analyzing the work of T. A. Sarymsakov, V. A. Bugaev and V. A. Dzhordzhio. *Subject Headings:* **1. Synoptic meteorology 2. Chain processes 3. Weather forecasting 4. Central Asia 5. Near East.**—*I.L.D.*

16.3–30 551.509.312:551.589(234.3)

Zenone, Eleno, **Die Steuerung der 24-stündigen negativen Bodendruckänderung und die Südstaulagen.** [Steering of negative 24-hour surface pressure changes and "Südstau" situations.] *Geofisica Pura e Applicata*, Rome, 37:289–302, **1957.** 6 figs., 6 refs. English, German and Italian summaries p. 289–290. **DLC**—The twice daily weather maps of the Ticinese Observatory and of the Swiss, West German and French Meteorological Services for January–June, 1956 were examined and 127 "Südstau" situations found, of which 36 were selected for study. The 24-hr pressure changes (isallobars) were analyzed and charted to show the relation between the position, orientation, displacement, etc. of these isallobars in Europe and the Eastern Atlantic, and the precipitation areas, duration of the "Südstau" (23–99 hrs, average 55 hrs), steering types and other forecast parameters. *Subject Headings:* **1. Isallobaric analysis 2. "Südstau" 3. Synoptic climatology 4. Southern Alps.**—*M.R.*

PRESSURE ANALYSIS

11.3–31 551.509.312/3

Lecce, B. and Del Trono, F., **"Campo barico permanente" ed "Onda stagionale" nella previsione a lunga scadenza.** ["Permanent baric field" and "seasonal wave" in long range weather forecasting.] *Rivista di Meteorologia Aeronautica*, Rome, 18(3):35–52, July/Sept. **1958.** 8 figs., tables, eq. Italian, French, English and German summaries p. 35. **DLC**—The idea of a "permanent baric field" as defined by the distribution of maximum or minimum 500 mb carrier wave values for a number of selected stations in the Northern Hemisphere is introduced and the monthly and annual variations noted from an analysis of data for Rome (1948–57) and for Paris (1950–57), and a graphical analysis of hemispheric data from the **Monthly Climatic Data for the World** (500 mb level). Applications are made to seasonal forecasting. *Subject Headings:* **1. Permanent baric field 2. Monthly climatic data for the world 3. Seasonal forecasting.**—*Author's abstract and M.R.*

11.3–32 551.509.312:551.576.4

Lund, Iver A. (*A. F. Research Center, Bedford, Mass.*), **Specifying weather conditions from the 700-mb height and the sea-level pressure patterns.** *American Meteorological Society, Bulletin*, 39(4):205–210, April **1958.** 10 figs., 3 tables, 6 refs., 4 eqs. **DWB, DLC**—The coefficient of rank correlation was computed between daily weather charts and "ideal" map types. This coefficient was used as a predictor to specify the ceiling height at a station. The

effectiveness of this predictor was compared to that of a slightly different predictor which weighted the differences in rank. It was found that weighting the differences improved the predictor. A "weather index" was derived from a combination of three predictors which weighted the differences in rank and one predictor which gave the difference in pressure between two points. This index was used to obtain an estimate of the occurrence probability of several categories of ceiling height. *Subject Headings:* **1. Correlation coefficients 2. Weather indexes 3. Ceiling height forecasting 4. Pressure patterns.**—*Author's abstract.*

11.3–33 551.509.313:551.543

Petrosiants, M. A. and Chernysheva, O. N., **Termobaricheskie polia intensivnykh oblasteĭ izmeneniia davleniia, Chast' 1.** [Thermobaric fields in areas of intense pressure variations, Pt. 1.] (In: Akademiia Nauk Uzbekskoĭ SSR. Institut Matematiki i Mekhaniki, **Meteorologiia i gidrologiia v Uzbekistane.** Tashkent, **1955.** p. 133–150. 13 figs., 8 tables, 3 refs., eqs.) **DLC**—From the point of view of qualitative hydrodynamic forecasting, the structure of the thermobaric field and of the high altitude planetary frontal zone in the region of intense pressure change are particularly important. Hence the author investigated 40 cases of pressure fall and 32 cases of pressure rise with a pressure tendency either greater or equal to 5 mb/3 hrs. The qualitative characteristics of thermobaric fields for 850, 700, 500 mb and 500–1000 mb are discussed with the aid of data on the curvature of isohypses and isotherms for 850, 700 and 500 mb and 500–1000 mb over areas of sharp pressure change (75 mb/3 hrs), changes in curvature of isohypses along the flow of regions of drop and rise in pressure, the angle between isohypses for 850, 700 and 500 mb and isotherms at these surfaces, position of the center of isallobaric regions of the relatively largest density of isohypses in the high altitude planetary frontal zone, variation of gradient temperature on isallobaric surfaces for the centers of isobaric surfaces and variation of temperature gradient along a front on isobaric surfaces for centers of isallobaric surfaces. A detailed analysis is given of typical synoptic processes associated with the rise and fall of pressure during the incursion of a western cyclone, during "plunging" cyclones and during powerful western cyclones. *Subject Headings:* **1. Thermobaric field analysis 2. Pressure variations.**—*I.L.D.*

STATISTICAL FORECASTING

11.3–34 551.509.314:519.24

Aubert, Eugene J.; Lund, Iver A. and Thomasell, Albert, Jr. (*all, Geophysics Res. Direc. Air Force Res. Center, Cambridge*), **Some objective six-hour predictions prepared by statistical methods.** *Journal of Meteorology*, Boston, 16(4):436–446, Aug. **1959.** 2 figs., 5 tables, 9 refs., 34 eqs. **DWB, DLC**—Predictions of pressure, temperature, precipitation, cloudiness, and visibility were prepared using linear regression methods. Factor-analysis techniques were employed for the purpose of isolating from a complex of variables a small number of factors which accounted for most of the variation of the predictand. A screening procedure was used to select from the same complex of variables those few variables which, when combined linearly, provided the "best" forecasts. Forecast equations were derived by both of the above methods using all of the available data. The data were then stratified on the basis of a precipitation criterion, and new forecast equations were derived. Four sets of forecasts were prepared and compared. No significant differences were noted. It was concluded that screening would be preferred because of its simplicity, that stratification was not helpful in this case, that the equations performed almost as well on new data as they did on the dependent data, and that the addition of cloudiness and precipitation to the list of predictors was rewarding. *Subject Headings:* **1. Statistical forecasting 2. Short range forecasting 3. Forecasting techniques.**—*Authors' abstract.*

11.3–35 551.509.314:551.542:519.24

Hare, F. Kenneth (*McGill Univ.*), **The quantitative representation of the North Polar pressure field.** (In: Polar Atmosphere Symposium, Oslo, July 2–8, 1956, **Proceedings, Pt. 1, Meteorology Section.** N. Y., Pergamon Press, **1958.** p. 137–150. 3 figs., table, 11 refs., 8 eqs.) Also issued in *Journal of Atmospheric and Terrestrial Physics*, London, Special Supplement, Pt. 1, 1957, pub. **1958.** p. 137–150. **DWB, DLC** -Suitable techniques as examined

at the McGill Arctic Meteorological Group, involve the methods of WADSWORTH, BRYAN and GORDON as well as that of GODSON. The former method comprises the fitting of the pressure to a series of orthogonal polynomial surfaces as developed by FISHER from TSCHEBYCHEFF's series, which enables the McGill analysts to express 80–95% of the geographical variance of pressure in the North Polar area in terms of 20–30 correlation coefficients, each completely independent. GODSON's method involves the use of Fourier transforms, in which the colatitude terms are expanded in orthogonal polynomials. Very high reductions of variance are obtained by the GODSON method, using a limited number of coefficients. Both methods will be used at McGill in a number of polar circulation studies. *Subject Headings:* **1. Pressure field analysis 2. Orthogonal polynomials 3. Statistical forecasting 4. Arctic air circulation 5. Arctic regions.** —*From author's abstract.*

11.3–36 551.509.314:519.24:551.524.35(788)

Leatherwood, R. K. (*WBAS, Denver, Colo.*), **Persistence of warm weather at Denver, Colorado.** *Monthly Weather Review*, Wash., D. C., 83(7):143–146, July **1955.** 6 figs., 3 tables, 5 refs. **DWB, DLC**—A 40-yr record of maximum temperatures at Denver is examined to identify sequences of days which show a maximum temperature 10°F or more above the normal. The actual persistence of a warm-weather regime is compared with that on chance, on an annual basis, and also during particular seasons in which comparable magnitudes of persistence might be expected. The skill scores of persistence forecasts for "tomorrow" and "tomorrow and the day after tomorrow" continuing a warm spell are computed for November–March and September–October regimes. *Subject Headings:* **1. Statistical forecasting 2. Temperature persistence 3. Denver, Colo.**—*Author's abstract.*

11.3–37 551.509.314:551.509.317:551.55(729)

*Lilly, Douglas K. and LaSeur, N. E., **A statistical study of some Caribbean wind data.** Florida. State Univ. Dept. of Meteorology. Contracts AF 19(604)-753, CWB-8586 and CWB-8822, Scientific Report No. 3, Dec. 1, **1956.** 32 p 14 figs., 14 refs., numerous eqs. **DWB** (M15.2 F636s)—The report discusses results of a pilot study of a 3 month (Sept. 1953, Aug. and Sept. 1954) sample of wind observations from stations in the tropical Atlantic and Caribbean area. Two main objectives prompted the study: first, the need for quantitative information on the magnitude and characteristics of local effects on the wind reports at each station in order that the data can be more intelligently used for synoptic wind analyses; and, statistical wind parameters together with their physical interpretation. Even with the limited data sample encouraging results emerge. Information obtained on the local effects have proved useful in synoptic wind analysis, while the statistical results indicate that extension of the computations to the improved network of stations now being established in connection with the National Hurricane Research Project should yield valuable and representative statistical parameters of the atmospheric flow in this region. More intensive evaluation of local effects, especially their interaction with synoptic features, is also planned. *Subject Headings:* **1. Synoptic wind analysis 2. Wind data 3. National Hurricane Research Project 4. Caribbean. I. Florida. State Univ. Dept. of Meteorology II. Contract AF 19(604)-753 III. Contract CWB-8586 IV. Contract CWB-8822.**—*Authors' abstract.*

UPPER AIR INFORMATION

11.3–38 551.509.317:551.587

Bugaev, V. A.; Dzhordzhio, V. A. and Petrosiants, M. A., **O sinopticheskoĭ interpretatsii aeroklimatograficheskikh dannykh.** [Synoptic interpretation of aeroclimatographic data.] *Tashkent. Geofizicheskaia Observatoriia, Trudy*, No. 11/12:124–131, **1956.** 3 figs., 6 refs. **DLC**—A general discussion of the best way to interpret aeroclimatological data synoptically. The data can be interpreted by the passive method which averages meteorological fields according to months and seasons, and the active method which uses circulation types. In the latter case, typical situations of the planetary upper frontal zone are taken as the basis of classification as they reflect the directions of prevailing currents in every case and the situation

of the basic pressure systems. *Subject Headings:* **1. Synoptic—aerological analysis 2. Upper air climatology data.**—*A.M.P.*

11.3–39 551.509.317:551.513.2:551.557.5

Fawcett, Edwin B. and Snellman, Leonard W. (*both, Headquarters, Air Weather Service*), **300-mb isotach analysis.** *American Meteorological Society, Bulletin*, 40(2):78–84, Feb. **1959.** 11 figs., 12 refs. **DWB, DLC**—A "mean-wind" technique is presented for estimating (for a constant-pressure level) the position and strength of the core of maximum winds between two rawinsonde stations located four to nine latitude degrees apart. An example of the application of the method is given, and shortcomings of the method are described. To test the method, 37 computations were made. The resulting core speeds and positions are compared with Project Jet-Stream flight winds and "Whooper" reconnaissance winds. The mean speed-error of the 37 computations is −3.5 kn and the RMS error is 17 kn. It is concluded that the "mean-wind" technique is operationally feasible and that its employment in conjunction with other analysis techniques now in use will contribute to analysis in the jet-stream region. *Subject Headings:* **1. Isotach analysis 2. Jet stream forecasting.**—*Authors' abstract.*

11.3–40 551.509.317:551.510.52:551.557

Fay, Richard (*Woods Hole Oceanog. Inst.*), **A note on the mid-tropospheric wind maximum.** *American Meteorological Society, Bulletin*, 39(7):360–362, July **1958.** fig., table, 3 refs. **DWB, DLC**—The mid-tropospheric maximum is characterized by a thermal wind increase, and then decrease of wind with altitude with no appreciable directional change. Surveying 10,186 soundings and using this criteria: 1) Maximum wind <7 km, 2) Sounding must reach 8 km, 3) Average wind >5 mps, and 4) Wind must increase, then decrease at least 3 mps through a 4 km altitude or less if <30° directional change, the findings were: 27.3% showed mid-tropospheric maximum, and the distribution with altitude at 3, 4, 5, 6, and 7 km was 8%, 17%, 27%, 26% and 21%, respectively. Time distribution was 27%, 30%, 27% and 23% at 03, 09, 15 and 21 GCT, respectively. Detailed analysis of temperature fields at 1 km intervals are plotted for several altitudes. Thermal shear stress, however small, may prove valuable in short range forecasting. Caution in extrapolation at 500 mb is advised. *Subject Headings:* **1. Mid-tropospheric wind maximum 2. Thermal winds 3. Short range forecasting.**—*W.N.*

11.3–41 551.509.317

†Flohn, Hermann, **Aktuelle Probleme der aerologischen Synoptik (Einleitendes Referat).** [Current problems in synoptic aerological meteorology: introduction.] *Germany. Deutscher Wetterdienst, Berichte*, 7(51):82–95, **1959.** 12 figs., 2 tables, 70 refs. German and English summaries p. 82. **DWB, DLC**—Review on tasks and further developments of synoptic-aerological meteorology: 1) Methods of representation and analysis of the 40 dimensional fields of the atmosphere; 2) Scales of meteorological phenomena, gap between macro- and micro-meteorology, synoptic concepts (air-mass, front, steering, large-scale weather pattern) and their evolution; 3) Qualitative and numerical, standardizing and individualizing approach; 4) Equilibrium and nonequilibrium of atmospheric fields; 5) The jet-stream problem in its fundamental significance; and 6) Possibilities and limits of improving the weather forecast, numerical and statistical methods. *Subject Headings:* **1. Synoptic aerology 2. Synoptic meteorology.**—*Author's abstract.*

11.3–42 551.509.317:551.506.7:551.507.362.1

§Greenfield, S. M., **Synoptic weather observations from extreme altitudes.** *Rand Corporation, Santa Monica, Calif.*, [*Papers*], P-761, Feb. 15, **1956.** 12 p. 6 figs. **DWB**—Clouds, albedo, temperature, wind and visibility observations from a rocket at extreme altitudes can give a fair picture of synoptic conditions at ground, as illustrated by actual examples from rocket soundings in N. Mexico during 1948 and 1950. In the latter cases the situations are described in detail and comparative synoptic charts (actual and made from rocket observations) for Southwest U. S. are shown. Method suggested to supplement surface and radiosonde data where none are available. *Subject Headings:* **1. Rocket synoptic observations 2. Rocket soundings 3. New Mexico.**—*M.R.*

11.3–43 551.509.317:551.547.1

Hughes, Lawrence A. (*U. S. W. B., Chicago, Ill.*), **On the determination of 500 mb height tendencies.** *American Meteorology Society, Bulletin*, 38(4):221–225, April **1957.** 3 figs., table, 5 refs., 8 eqs. **DWB**—The methods for computing "instantaneous" upper level pressure or height tendencies are revised to allow computation of the 500 mb height tendency using the observed surface (or sea level) pressure tendency and an appropriate portion of the 1000–500 mb thickness advection. An evaluation is made as to what constitutes an appropriate portion of the thickness advection. Use of the method is discussed and an example is given. *Subject Headings:* **1. 500 mb height tendencies 2. Thickness tendency computation.**—*Author's abstract.*

11.3–44 551.509.317:551.524.7:551.515.713

Lenova, G. V., **Ispol'zovanie polia temperatury na vysote poverkhnosti 500 mb pri prognoze obrazovaniia i peremeshcheniia severo-zapadnykh antitsiklonov.** [Use of the 500 mb level temperature field in forecasting the formation and displacement of northwestern anticyclones.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 63:77–86, **1957.** 4 figs., 3 tables, 6 refs. **DLC**—The results of a study of 72 cases of formation and displacement processes of northwestern anticyclones moving over European U.S.S.R., based on synoptic data for 1938–1940 and 1946–1954. It was found that the use of the temperature field at the 500 mb level makes it possible to rather easily determine the regions of anti- and cyclogenesis and the stability of the regions in time. No cyclones will move into a region occupied by a strong inflow of cold air, and the movement of an anticyclone should not be expected in a region of heat advection. *Subject Headings:* **1. Anticyclone forecasting 2. Upper air temperature-pressure correlations.** —*A.M.P.*

11.3–45 551.509.317:551.547.1:629.13

McCulloch, James A. W. (*Met. Office, Goose Bay, Labrador*), **Applications of thickness methods to forecasting "D" factors and to interpolating.** *Royal Meteorological Society, Canadian Branch, Publication*, 8(5):10–24, Nov. **1958.** 7 figs., 3 refs. **DWB**—The use of thickness patterns for forecasting heights and "D" factors between mandatory levels is described. Tables are presented showing the vertical lapse-rate of "D" factor as a linear function of thickness between two mandatory levels. An example of the determination of "D" factors along a flight-route by applying forecast thickness values to these tables is provided. A method of constructing contour height charts at levels between mandatory levels is described; the solution is extended to the construction of "D" factor charts. *Subject Headings:* **1. Thickness tendency computation 2. "D value" forecasts.**—*Author's abstract.*

11.3–46 551.509.317:551.524.7:551.594.11(456.3)

Migliardi, Ernesto, **Esperimenti di previsione in quota.** [Experiments in upper level forecasting.] *Rivista di Meteorologia Aeronautica*, Rome, 19(3):39–42, July/Sept. **1959.** tables, 6 refs. Italian, French, English and German summaries p. 39. **DLC**—Results of research carried out on the behavior of interdiurnal variations of geopotential and temperature at the different standard levels (850, 700, 500, 300 and 200 mb for Rome, winter 1958–59), followed by a discussion of the possibility of applying these results to upper air forecasting for the Mediterranean Region. *Subject Headings:* **1. Upper air forecasting 2. Interdiurnal temperature variations 3. Interdiurnal geopotential variations 4. Rome, Italy.**—*Author's abstract.*

11.3–47 551.509.317

U. S. Air Weather Service, **Use of geostrophic distance in analysis and forecasting.** Its *Technical Report*, 105-98 (rev.), Sept. **1954.** 13 p. 6 figs., 2 tables. **DWB** (M055 U58a)—The concept of geostrophic distance as defined by J. C. Bellamy, is clearly explained and illustrated, and the usefulness in synoptic analysis, forecasting and special studies demonstrated. Practical scales for such use are also presented and their construction outlined. The advantages of geostrophic distance scales over the inverse type of geostrophic scale used conventionally, are listed. Among these are the convenience in spacing upper air contours about a single wind report or a narrow jet stream rather than having to use the difference in heights

or winds from 2 neighboring stations; crosswind and technical components can be calculated over long routes. Disadvantages are few. *Subject Headings:* **1. Geostrophic distance scales 2. Upper air analysis. I. Bellamy, J. C.**—*M.R.*

11.3–48 551.509.317:551.577.1

Wagner, A. James (*Mass. Inst. of Tech.*), **Mean temperature from 1000 mb to 500 mb as a predictor of precipitation type.** *American Meteorological Society, Bulletin,* 38(10):584–590, Dec. **1957.** 6 figs., 2 refs., eqs. **DWB, DLC**—The frequency of occurrence of frozen precipitation forms relative to the frequency of occurrence of nonfrozen forms is determined as a function of geographical location and of the mean temperature (or thickness) of the layer from 1000 mb to 500 mb. The results are derived from the data for a large number of stations in the United States during two winter seasons. A map of the thickness values for equal probability of occurrence of frozen and nonfrozen forms illustrates the effects of altitude and continentality. It is found that the form of the precipitation can be specified with a confidence of 75% or more when the thickness value at a station is 100 ft or more from its "equal probability" value. Some refinements of the technique are discussed. (Abstracted from another source as 9.3–221, March 1958, *MAB.*) *Subject Headings:* **1. Precipitation type forecasting 2. Thickness charts (500–1000 mb) 3. Temperature-precipitation relationships 4. United States.**—*Author's abstract.*

LARGE SCALE SYNOPTIC PROCESSES

11.3–49 551.509.318:551.578.45

Bailey, R. E., **Forecasting of heavy snowstorms associated with major cyclones.** Eastern Air Lines, Inc., Met. Dept., Contract AF 19(604)-2073, Scientific Report, No. 1, April **1958.** p. 142–157. 7 figs. **DWB** (M09.318 E13sc)—Examination of forecasting parameters for about 150 snowstorms associated with North American winter cyclones reveals that a combination of well-known forecasting techniques will successfully delineate heavy drifting snowstorms and blizzards from "average" snowstorms of less than 10 in. It was found that over 50 severe snowstorms were associated only with the active deepening stage of a major cyclone, for which a simplified forecasting technique is developed from current jet stream theory. *Subject Headings:* **1. Snowstorm forecasting 2. Severe snowstorms—cyclone relationships 3. Forecasting techniques.**—*Author's abstract.*

11.3–50 551.509.318:551.513.2

Bedrina, V. S.; Kurganskaia, V. M. and Chapygina, N. M., **Povtoriaemost' elementarnykh sinopticheskikh protsessov s meridional'nym tipom tsirkuliatsii.** [Recurrence of elementary synoptic processes with a meridional circulation.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy,* No. 56:71–93, **1957.** 5 figs., 5 tables, ref. **DLC**—In this study the frequency of natural synoptic processes in different parts of the first natural synoptic region, the criteria of analogousness and nonanalogousness are specified, the existence of analogous and nonanalogous processes over the territory examined (namely the entire Eurasian continent and the North Atlantic Ocean) are determined, and the statistical relationships between processes arising in the course of various periods before and after the initial processes are established. From ten years (1945–1954) of aerosynoptic material, 118 instances were selected which satisfied conditions in which upper level field was characterized by a well developed thermal ridge of a subtropical anticyclone oriented northwards with its peak at least up to 65–70°N lat.; by a high ridge bounded by two cyclonic troughs extending southwards to 45–40°N lat. and by a frontal zone formed by the ridge and the eastern trough oriented more or less along the meridian; and to the field aloft—a meridionally direct field of high pressure bounded on the east and west by cyclonic system which should correspond on the synoptic map. On the basis of geographical indices i.e. according to the region of formation of the warm ridge aloft and surface high pressure beneath this ridge during the spread of cold air masses from the north into temperate and southern latitudes, four types of natural processes with meridional circulation are established. These are: Type I (Atlantic), Type II (Scandinavian), Type III (European) and Type IV (Ural). Their characteristics are described with the aid of synoptic maps and data are pre-

sented on the frequency of these four synoptic processes, the establishment of analogous processes for different areas (in percent of total area), the frequency of analogous processes and the frequency of elementary synoptic processes with meridional circulation type. The correlation coefficients computed for each period of all cases examined amount to −0.24 for the 3-month period, −0.18 for the 4-month period and −0.24 for the 5-month period. The negative correlation coefficients indicate the presence of a definite relationship between synoptic processes at equal intervals from the examined bench mark natural synoptic processes. But the small correlation values indicate that these relationships are not adequate for using the periodicity of natural synoptic processes with meridional circulation in forecasting. An appendix giving the frequency of synoptic processes with meridional circulation types during the 10-year period is presented. *Subject Headings:* **1. Natural synoptic periods 2. Meridional circulation 3. Eurasia 4. North Atlantic Ocean.**—*I.L.D.*

11.3–51 551.509.318:551.524.35(497.2)

Blagoev, Khr. and Lalovski, Khr., **Sinoptichni obstanovki na singularitetite na temperaturata v Bulgariia.** [Synoptic periods of temperature singularities in Bulgaria.] *Khidrologiia i Meteorologiia*, Sofia, No. 5:62–73, **1958.** 4 figs., 4 tables, 5 refs. Russian and English summaries p. 72–73. **DLC**—An examination of the tables for the average values (daily, by pentads, etc.) of temperature, or the corresponding graphs, reveals several singularities, more or less marked. Three of the more striking singularities are discussed, e.g., the new year's warming, the heat days at the end of July and old wives' summer. These warmings almost invariably occur when there is a warm ridge over the Balkan Peninsula, or in the front part of a Mediterranean cyclone centered over Italy, or in the southeastern part of a large depression centered over Western Europe. *Subject Headings:* **1. Temperature singularities 2. Natural synoptic periods 3. Bulgaria.**—*From authors' abstract.*

11.3–52 551.509.318

Borisova, L. G. and Tsepkanova, E. I., **Povtoriaemost' nekotorykh tipov estestvennykh sinopticheskikh periodov.** [Recurrence of certain types of natural synoptic periods.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 56:108–127, **1957.** 7 figs., 5 tables, 8 refs. **DLC**—The frequency of several types of natural synoptic processes is investigated in order to derive forecasting indices and to obtain quantitative criteria of analogousness and validity for forecasting rules established by Multanovskiĭ, Pagava and Bliumina. Atmospheric processes in the entire lower half of the troposphere, in particular the processes at the earth's surface, were examined. The frequencies of the types of natural synoptic periods characterized by ridges aloft, by stationary anticyclones and by isolated cyclones were investigated. In the case of the natural synoptic periods with ridges aloft it is shown that the rule used in long range forecasting (that if for a given interval up to the initial period a nonanalogous process was observed then in the same time interval after the initial process an analogous process will be present and vice versa) is valid. Also if in those cases when, for a given interval up to the initial one, an analogous process was observed then in the same interval after the initial one an analogous process will occur. The verification of the long range forecasting rules for the two other natural synoptic periods is discussed. *Subject Headings:* **1. Natural synoptic periods 2. Long range forecasting 3. Forecasting rules.**—*I.L.D.*

11.3–53 551.509.318:551.515.4:551.511

§Breiland, John G. (*Univ. of New Mexico*), **Meteorological conditions associated with the development of instability lines.** *Journal of Meteorology*, Boston, 15(3):297–302, June **1958.** 10 figs., 14 refs., eq. **DWB, DLC**—From a large number of synoptic analyses of the development of instability lines over the U. S. (from standard surface and upper level charts, cross sections taken perpendicular to the instability line, temperature and humidity sections, etc.), the author concludes that "although moisture and thermal instability are necessary factors for the development of thunderstorms and showers, these factors are not, by themselves, sufficient for the development of the typical instability line." Areas of weak confluence of strong horizontal winds in the lower levels are found to be the ones where instability lines are most likely to develop. As an example of the method of analysis used, a study of synoptic

development in the S.W. United States on Oct. 29–30, 1948 is included. *Subject Headings:* **1. Instability line 2. Synoptic conditions for instability lines.**—*G.T.*

11.3–54 551.509.318:551.577.37(595.13)

§Bryant, K., **Comparison of months giving extremes of rainfall during northeast monsoon at Changi, Singapore Island.** *Meteorological Magazine*, London, 87(1036):307–312, Oct. **1958.** 4 figs., 3 refs. Also: **Comments** by F. J. McGaw. *Ibid.*, 89(1052):93, March **1960. DWB**—A review of synoptic conditions over the East Indies during December 1954 and January 1955, by means of surface pressure and 3000 ft streamline charts for a typical situation in each respective month; December, when Changi, Singapore Island had 3 times normal rainfall (36 in.) and January, which had $\frac{1}{5}$ of the 54 year mean (<2 in.) at that station. Three days in December (9th, 13th and 16th) accounted for $\frac{2}{3}$ of the month's rainfall. Both months are in the N.E. monsoon season, but during the wet period a convergence area lay just N.E. of Singapore and the situation was similar to that triple point situation favorable for typhoon formation (only Singapore lies too close to the equator for a typhoon to form). During January the convergence lay S.W. over the Cocos Islands, with straight N.E. monsoonal flow over Singapore. *Subject Headings:* **1. Synoptic case history studies 2. Extreme monthly rainfall 3. Singapore Island.**—*M.R.*

11.3–55 551.509.318:628.84

Buchberg, Harry (*Dept. of Engr., Univ. of Calif. L. A.*), **Electric analogue prediction of the thermal behavior of an inhabitable enclosure.** *American Society of Heating and Air-Conditioning Engineers, Transactions*, 61:339–386, pub. **1956.** figs., tables, refs., eqs. **DWB** (P A512sw)—Tests made during Sept. 1953, using a test house on the roof of the Engineering Building at UCLA, are reported and discussed. The analog method is used for solution of the thermal circuits. Data obtained for Sept. 8, 1953 show the solar energy absorbed during the 24 hrs (both direct measurement and analog input) by east and west walls, green and white roofs, long wave loss by green and white roofs, roof surface temperatures, east and west wall temperatures; N.S. wall, floor, glass surface temperatures; outside and inside air temperatures and air conditioning load to maintain 86°F. Detailed curves of solar and sky radiation, convective exchange outside and in, and inside radiation parameters are appended and discussed. The analog predictions are in good agreement with observed values and can handle a number of parameters at once. *Subject Headings:* **1. Analog prediction of air conditioning load 2. Radiation balance of houses.**—*M.R.*

11.3–56 551.509.318:551.577.37

Donchev, K. G., **Sinoptichni usloviia za obilni i prodŭlzhitelni valezhi v Bŭlgariia prez letnite mesetsi.** [Synoptic conditions for abundant and prolonged precipitation in Bulgaria during the summer months.] *Khidrologiia i Meteorologiia*, Sofia, No. 2:23–34, **1957.** 6 figs., 8 refs. Russian and English summaries, p. 33–34. **DLC**—The formation or intensification of precipitation over Bulgaria during the summer months is usually due to the following types of synoptic environment: 1) Formation and stability of sharply defined convergence in the friction layer. In such environment, conditions favoring powerful ascending movements in the pressure trough formed over Romania and over part of Bulgaria, due to orographic effects, are created on both sides of the convergence line. 2) Invasion of successive waves of cool and unstable air of maritime origin from northwest (and occasionally from northeast). 3) Passage of a Mediterranean cyclone. During the period 1953–1955 the first type of synoptic environment has been observed 16 times (35%), the second type 25 times (54%) and the third type 5 times, or in 11% of the cases of heavy precipitation. *Subject Headings:* **1. Synoptic conditions for heavy rainfall 2. Bulgaria.**—*Author's abstract.*

11.3–57 551.509.318(261)

†Dzerdzeevskiĭ, B. L., **Nekotorye osobennosti poluvekovogo rezhima tsirkuliatsii atmosfery nad severnoĭ Atlantikoĭ.** [Some characteristics of the 50 year regime of atmospheric circulation over the North Atlantic.] *Leningrad. Gidrometeorologicheskiĭ Institut, Trudy*, No. 5/6:191–199, **1956.** 5 figs., table, 25 refs. Abstracted from separated pages. **DWB**—In this study of the atmospheric circulation over the North Atlantic the circulation types de-

veloped by the author and termed "elementary circulation mechanisms" are grouped into fou classes, namely: I—the northern Atlantic which is under the influence of a zonal circulatio consisting of westerly currents associated with cyclonicity northwards from 55°N lat. and wit anticyclonicity south of this latitude; II—circulation types associated with a well marke incursion of Arctic air across northern latitudes; III—types characterized by a more southerl "normal" position of all circulation elements and IV—types characterized by a meridiona circulation towards the Arctic from southerly latitudes. An analysis of the seasonal frequencie of the various groups (averaged for 1899–1948), indicates that group III has the highes frequency; group I (zonal) and group II (meridional) have similar frequencies throughout th year; group IV has a slight seasonal variation. The long period variation of the circulatio groups determined by 10-year moving averages shows that between 1912–1921 and 1932–194 groups I and II showed opposite variations, and group IV increased gradually. During thi period there was a marked decline in the frequency of Arctic incursions. The early paralle course of groups I and II is explained by the variation of group III which is opposite to thes two groups; the decrease of the number of days with zonal circulation and with circulatio displaced in higher latitudes is compensated by less powerful and more frequent meridiona incursions in the rear of the transitory but more southerly trajectories of cyclones. Th analysis of the deviations of the curves from the 50 yr mean of the frequency of different group of circulation types for each season and for the entire year indicates that in the first two decade of the present century the contrast between the variation of groups I and III was considerably more marked; in the last two decades (period of change in the character of the circulation accompanied by extensive areas of heating) the contrast was more marked between groups and II. Hence the second period is characterized not only by the intensification of cyclonicity in the north Atlantic and extensive decrease in the number of strong Arctic incursions bu also by the northward displacement of the circulation elements periodically furthering the zonality in the area and alternating with the rear meridional incursions. *Subject Headings:* **1. General circulation over North Atlantic 2. Circulation type frequencies 3. Long perio circulation records 4. North Atlantic.**—*I.L.D.*

11.3–58 551.509.318:551.575

Emslie, J. H., **An investigation of the fog situation at Comox, B. C., November 22–30 1956.** *Canada. Meteorological Branch, CIR*-2998, TEC-262, Local Forecast Study, No. 33 Jan. 8, **1958.** 6 p. fig., 2 refs. **DWB, DLC**—The synoptic situation during this period of fog occurrence involved an extensive ridge of high pressure over the West Coast of North America with a light circulation aloft and near calm winds at the surface. A shallow inversion developed over Vancouver Island and the lower mainland of British Columbia with warm, very dry air aloft and cold moist stable air below. No frontal system affected the area during this period. The theory of inversion fog formation is summarized briefly. Data are presented showing nine cases where a drop of temperature below freezing and formation of frost improved visibility to above aircraft take-off limits, five cases where take-off limits were attained through diurnal heating, one case where the temperature did not drop below freezing at night and no improvement in visibility occurred and three cases where improvement through diurnal heating did not reach take-off limits. The use of the frost forecast in planning aircraft departures during the fog period is discussed. *Subject Headings:* **1. Synoptic conditions for fog 2. Inversion effects on fog formation 3. Comox, British Columbia.**—*I.L.D.*

11.3–59 551.509.318:551.579.4

Gavrilenko, N. M., **Sinopticheskie usloviia ekstremal'no rannikh i pozdnikh vesennikh polovodiĭ na r. Dnepr u Kremenchuga.** [Synoptic conditions of extremely early and late spring floods of the Dnieper River at Kremenchug.] *Kiev, Ukraine. Nauchno-Issledovatel'skiĭ Gidrometeorologicheskiĭ Institut, Trudy,* **4**:11–17, **1955.** 3 figs., 3 tables, 5 refs. **DWB, DLC**—On the basis of some fourteen years characterized by early spring floods on the Dnieper River the author analyzed the synoptic conditions associated with this phenomenon which begins with a sharp rise in air temperature. Those types of synoptic processes are described with the aid of maps. The earlier beginning of spring floods at Kremenchug is associated with a sharp rise of air temperature during the second half of winter as a result of the transport of warm air from the Mediterranean and Black Seas to the Ukraine and Byelorussia. The occurrence of

late spring floods is associated with a sharp rise of air temperature as the result of warming of the Ukraine by advective warm air around the periphery of a high stationary anticyclone occupying the eastern half of European U.S.S.R. or by the movement of individual cyclones from the south across the Ukraine during considerable anticyclogenesis over Western Europe. Data are presented on the number of days with the different circulation types per year with early spring floods (late spring floods) during the months preceding the occurrence of floods. A graph showing the dependence of the dates of beginning of spring floods on the Dnieper at Kremenchug upon the index of circulation in Europe during the preceding winter season (January month) and a table showing the distribution of computed dates of beginning of spring floods are presented. *Subject Headings:* **1. Synoptic conditions for floods 2. Synoptic analysis 3. Floods, Kremenchug 4. Kremenchug, Ukraine.**—*I.L.D.*

11.3–60 551.509.318(234.3)

Gensler, G.-A.; Piaget, A. and Schneider, R., **Essai de classification des situations météorologiques dans les Alpes; premières applications.** [Attempt at the classification of meteorological situations in the Alps; first applications.] *Schweizerische Naturforschende Gesellschaft, Verhandlungen*, 134:111–112, **1954.** ref. **DWB, DLC**—The classification principle is based on pressure differences reduced to sea level and on surface heights of 500 mb for 2 pairs of stations (Milan-Strasbourg and Munich-Lyons). The division consists of 3 sectors: the north and south of the Alps and the Alps themselves. The differences provide 4 values preceded by the sign + or −, depending on whether the pressure or the height of the 500 mb surface at Milan or Munich is higher than at Strasbourg or Lyons and conversely. The different possible combinations of the 4 signs lead to 10 possibilities or situations. Other secondary data have been introduced. The two areas connecting the two pairs of stations form a system of coordinates. The frequency distribution of situations is very variable, and each situation presents a very definite seasonal maximum. The vector at 500 mb represents the mean wind in the region considered, at 550 m. The interpretation of values obtained at the ground is not so simple. *Subject Headings:* **1. Weather types 2. Synoptic studies 3. Alps.**—*From authors' summary.*

11.3–61 551.509.318:551.577.38:551.555.3(47)

Glukh, I. S., **Tsirkuliatsionnye usloviia, podgotavlivaiushchie razvitie atmosfernoĭ zasukhi i sukhoveev.** [Circulation conditions leading to the development of atmospheric dryness and dry winds.] (In: Akademiia Nauk SSSR. Institut Geografii, **Sukhovei ikh proiskhozhdenie i bor'ba s nimi.** Moscow, **1957.** p. 131–137. 3 tables, 21 refs.) **DLC** (QC940.R9A6)—An analysis of the recurrence of anticyclonic and cyclonic circulation in "sukhovei" and non-"sukhovei" decades in the forest-steppe, steppe, and semi-desert zones of European U.S.S.R. during 1948–1952, showed that drought and "sukhovei" periods are connected with: high pressure regions which bring clear weather, etc. heating up of the underlying surface and of air masses above it. *Subject Headings:* **1. Synoptic conditions for drought 2. Sukhovei 3. European U.S.S.R.**—*A.M.P.*

11.3–62 551.509.318:551.509.33

Hess, Paul (*Frankfurt a.M.*), **A cirkuláció jellemzői európai makroszinoptikus helyzetekben.** [Circulation characteristics in European large-scale synoptic situations.] *Időjárás*, Budapest, 61(4):253–259, July/Aug. **1957.** 3 figs., 2 tables, 3 refs. Hungarian and English summaries p. 253. German version p. 314–317. **DLC**—A list of Baur's large scale synoptic situations (Grosswetterlagen) currently used in weather services is given. Classification by these types has been done by subjective methods in the past. In this paper, the author proposes an objective method (based on various relations of the zonal and meridional components of the circulation over the Atlantic and over Europe) for determining the prevailing large-scale synoptic situation type. *Subject Headings:* **1. Grosswetterlagen 2. Synoptic types.**—*G.T.*

11.3–63 551.509.318

Kalmykova, N. M., **Analiticheskoe predstavlenie poleĭ meteorologicheskikh elementov.** [Analytic representation of the field of meteorological elements.] *Moscow. Tsentral'nyĭ*

Institut Prognozov, Trudy, 46(73):79–83, **1956.** 2 figs., table, 2 refs., 9 eqs. **DLC**—In addition to a general discussion of the principle of analogousness of various meteorological fields, the author attempts to establish some numerical indices of the analogousness of meteorological fields on the basis of the simplest application of the theory of probability. The totality of fields of a meteorological element established at a given interval of time is termed a random field and is represented by random sequence of the functions $\varphi \ldots \varphi_2, \varphi_3 \ldots \varphi_k$ each of which depends upon the coordinates x, y, time t and parameter X. The method of evaluating analogousness presented is based upon that of N. A. Bagrov and on G. I. Morskoĭ for the evaluation of forecasts. Analogousness is measured by a function $f(\delta)$ forming only in the case of complete similarity ($\delta = 0$) and zero when comparable fields at a given point are most dense. Equations for determining the function and numerical results are presented. *Subject Headings:* **1. Analogues 2. Probability theory.**—*I.L.D.*

11.3–64 551.509.318:551.577.37(52)

Kikuta, I., **On the heavy rainfall in the domain of Westerlies.** *Journal of Meteorological Research*, Tokyo, 9(12):878–884, Dec. **1957.** 14 figs., 9 refs. In Japanese; English summary p. 878. **DWB, DLC**—This report is a case study on the heavy rainfall in the domain of the westerlies over Japan, during the period of 1–3 July, 1952 and it is pointed out that: 1) in western Japan the region of heavy rainfall is observed just north of the jet stream in the lower layer; 2) excellent qualitative agreement is evident between the distribution of rainfall amount and that of vorticity at the 850 mb surface; 3) joint relationship of the dew-point temperature and vorticity at the 850 mb surface with the rainfall amount is shown in figs. *Subject Headings:* **1. Synoptic studies 2. Synoptic conditions for heavy rainfall 3. Japan.**—*Author's abstract.*

11.3–65 551.509.318:551.513

Kist, M. Ia., **Ul'trapoliarnye repernye protsessy i sposob kontrolia analogichnykh i obratnykh protsessov.** [Transpolar bench mark processes and a method of controlling analogous and opposite processes.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 56:5–30, **1957.** 8 figs., 2 tables, 9 refs. **DLC**—This study of the characteristics of initial bench mark transpolar circulation processes and the values of analogous and reverse processes is based on fourteen years of data (1938–51) from daily synoptic surface maps, pressure topography and secular mean maps of absolute topography of the 500 mb surface for natural synoptic seasons for the first natural synoptic region. The analysis was carried out for the entire European continent, adjacent North Atlantic, Pacific Oceans and the Eurasian sector of the Arctic. The analysis of 104 synoptic kinematic maps of initial bench mark transpolar processes and upper altitude maps (500 mb) and of 712 synoptic kinematic maps for standard time intervals led to the following conclusions: transpolar bench mark processes of types I and II are similar in their variants, their occurrence is characterized by meridional circulation and they extend over a large part of the first natural synoptic region. In the majority of cases the meridionality of flow and the displacement of pressure formations are observed between 50° and 80°N lat. and rarely between 50° and 40°N lat.; south of 40°N lat. they are usually absent. During the analogous process a probability of coincidence of the sign of the surface pressure field of 70% and more is observed in regions of transpolar circulation mechanisms (trough-ridge-trough); in the reverse processes in the same region it does not exceed 30–40%. In the region of transpolar activity the probability of coincidence of the sign of the pressure field is 90–100% in an analogous process and 0–10% in a reverse process. Ninety to ninety-five percent of the processes analogous to the initial bench mark process are characterized by a coincidence of the pressure field sign over 65% of the territory of the first natural synoptic period or over 60% of this area if lower latitude processes are considered. *Subject Headings:* **1. Transpolar bench mark processes 2. Natural synoptic periods 3. Europe 4. Arctic Eurasia.**—*I.L.D.*

11.3–66 551.509.318:551.579.4

†*Kozik, E. M., **Aerosinopticheskie usloviia obrazovaniia pavodkov na rekakh Sredneĭ Azii i ikh kratkosrochnyĭ prognoz.** [Aerosynoptic conditions for flood formation in rivers of Central Asia and their short range forecasting.] *Tashkent. Geofizicheskaia Observatoriia,*

Trudy, No. 10(11):3–76, **1954.** 16 figs., 28 tables, 34 refs. **DLC**—Methods and results of a detailed study of the problem studied in the Forecasting Sector of Uzbek S.S.R. Hydrometeorological Service Administration are described. Synoptic processes in which flood formation can be observed on the Chirchik and other Central Asian rivers, as well as qualitative and quantitative dependence between aerosynoptic characteristics of flood formation and air masses, have been established. The established rules for forecasting the extent of floods on the Chirchik River can be applied, in the presence of all kinds of synoptic processes except "wave activity," to other mountain rivers of Central Asia. The floods can be forecast one to two days in advance. *Subject Headings:* **1. Synoptic conditions for floods 2. Flood forecasting 3. Central Asian rivers.**—*A.M.P.*

11.3–67 551.509.318:551.579.4

†*Kozik, E. M., **Aerosinopticheskie usloviia obrazovaniia pavodkov v period iiul'-sentiabr' na rekakh Chirchik, Kara-Dar'ia i Zeravshan.** [Aerosynoptic conditions for flood formation in the period July–September in the Chirchik, Kara-Darya, and Zeravshan Rivers.] *Tashkent. Geofizicheskaia Observatoriia, Trudy*, No. 10(11):77–107, **1954.** 6 figs., 22 tables, 5 refs. **DLC**—This paper is a continuation of the preceding work (*see* 11.3–66) for the months July–September Its purpose is to establish the aerosynoptic conditions under which sudden (several days) flood formation can take place on Central Asian rivers, and to determine the meteorological factors that can affect it most strongly. The author adds that in the presence of all types of synoptic processes, and particularly in the presence of thermal depressions, similar temperature conditions are sometimes but not always accompanied by floods, especially in rivers that are fed by glaciers. There is no doubt that the development of convective cloudiness in mountains is one of the most important factors in such cases. *Subject Headings:* **1. Synoptic conditions for floods 2. Flood formation 3. Central Asian rivers.**—*A.M.P.*

11.3–68 551.509.318:551.515.71(497.2)

Lalovski, Khr. and Blagoev, Khr., **Antitsiklonalen tip vreme v Bŭlgariia.** [Anticyclonic weather type in Bulgaria.] *Khidrologiia i Meteorologiia*, Sofia, No. 1:14–21, **1958.** table, 2 refs. Russian and English summaries p. 20–21. **DLC**—The article discusses the various types of anticyclones which form over Bulgaria, their frequency during the different months of the year and their duration. It describes the character of the weather in anticyclonic conditions, depending on the air mass in which the anticyclone is formed and the peculiarities of the seasons. As to the duration of anticyclonic conditions, the greatest in number are those of two days duration, followed by those of one day, three days, etc. August has the greatest average duration: 5.6 days, followed by April, July, September and October (4 days), while May, June and December have the shortest duration (2.5–2.7 days). About 30% of all days throughout the year have anticyclonic conditions. The investigation shows that the anticyclonic weather type is followed most frequently by the oceanic weather type, less frequently by Mediterranean and continental type, and most seldom by the weather type of dissolved pressure field. The lowest minimum temperatures occur in Bulgaria when an anticyclone is formed in an Arctic air mass. Some of the highest temperatures observed in Bulgaria during the summer season are in the cases when an anticyclone is formed in continental, tropical air mass. *Subject Headings:* **1. Synoptic types 2. Anticyclone classification 3. Bulgaria.**—*Authors' abstract.*

11.3–69 551.509.318:551.558.2:551.509.324.2

Miller, Albert; Panofsky, Hans A.; Curtis, Robert C. et al., **Vertical motion and weather, January 1–31, 1953.** Pennsylvania. State Univ. Mineral Industries Experiment Station. Dept. of Meteorology, Contract AF 19(604)-1025, Scientific Report, No. 2, Jan. 1, **1957.** 62 p. 5 figs., 18 tables, 3 refs., eqs. **DWB**—The object of this study is the use of the field of large scale motion as a predictor of cloudiness and precipitation. Frequency distribution, absolute magnitude, and diurnal variation of the large scale vertical motion in the middle troposphere (700 mb) are derived. The five methods for obtaining the large scale vertical motions are: the kinematic, the adiabatic, the vorticity, the combined adiabatic-vorticity and the precipitation rate methods. Under the program of investigation cloudiness and precipitation are

discussed and precipitation rate is considered of greater value to the forecaster than the incidence. The effect of moisture on the weather, and how weather is related to both averaged vertical velocity and moisture parameters are treated. Tabular analyses are given for purposes of comparison. The material also contains some regression equations computed for some of the relationships investigated, along with the correlation coefficients. *Subject Headings:* **1. Large scale vertical motion 2. Precipitation forecasting. I. Julian, Paul R. II. Jones, David L.**—*N.N.*

11.3–70 551.509.318:551.515.8(73)

Miller, James E., **Composite charts of some synoptic features of squall lines.** (In: N. Y. Univ. College of Engineering. Research Div. Dept. of Meteorology and Oceanography, Contract AF 19(694)-1387, **Final Report,** June **1958.** p. 33–47. 7 figs., table, ref.) **DWB** (M15 N532s)—Twenty-four squall line situations in the U. S., selected at random, are analyzed; and composite charts are constructed showing the typical patterns of temperature axes, fronts, stability, precipitation, and jets. It is concluded that differential advection is an important factor in squall lines. *Subject Headings:* **1. Synoptic conditions for squall lines 2. Squall lines 3. United States.**—*Author's abstract.*

11.3–71 551.509.318:551.575.1(485)

Morales, C. (*Met. Inst., Uppsala*), **Synoptic and mesoaerological study of radiation fog: preliminary report on radio soundings with tethered balloon and single observer.** *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A,* 10(4):387–409, **1958.** 12 figs., 4 tables, 12 refs. English, German and French summaries p. 387–389. **DWB, DLC**—The present study was for the purpose of determining the conditions necessary to the formation of radiation fog. The temperature and relative humidity of the lowest stratum of the troposphere were sounded with a tethered balloon and radiosonde during a number of nights when the conditions were considered favorable for the formation of radiation fog: clear weather with effective net radiation, light wind, and high relative humidity at ground level. Advection fog was also studied on some occasions for comparison. The measurements were carried out in Uppsala. Meteorological phenomena of possible importance to the study were recorded concurrently with the measurements. The weather was analyzed synoptically and aerologically also on each occasion. The results of the investigation suggest that the conditions necessary to the formation of radiation fog are not only an effective net radiation, light wind, and high relative humidity at ground level, but also that the wind must be light and the relative humidity high at some distance above the ground. This permits the more or less marked surface inversion to leave ground level and to rise as a layer of rapid temperature transition. This is brought about by the radiation gradually emitting from the upper surface of the layer of mist or fog, formed in the lowest and chilled air strata, which are subsequently cooled from above until an unstable lapse rate develops. As a result, the layer of rapid temperature transition is maintained rather intact as it rises. If the radiation continues without obstruction and the wind is light aloft, this layer migrates upwards until it reaches a level at which the relative humidity is so low that the cooling necessary for condensation does not occur by radiation, limiting the extension of the underlying fog. If the relative humidity is high only in the undermost air strata, the surface, inversion cannot leave ground level and no fog will be formed aloft. If the wind is strong aloft, the process is hindered by the increased turbulent exchange occurring between the high and low strata. *Subject Headings:* **1. Radiation fog 2. Synoptic conditions for radiation fog 3. Uppsala, Sweden.**—*Author's abstract.*

11.3–72 551.509.318:551.509.33

Ped', D. A., **O nekotorykh osobennostiakh tsirkuliatsii v estestvennykh sinopticheskikh periodakh.** [Certain features of circulation in natural synoptic periods.] *Meteorologiia i Gidrologiia,* Leningrad, No. 8:28–31, **1957.** 4 figs., 6 refs. **DLC, DWB.** Transl. into English available. **DWB** (M09.318 P371ce)—The use of natural synoptic periods (introduced by V. P. Multanovskiĭ) does not lead to successful results in long range forecasting because only quantitative approaches are employed in the analysis and forecasting synoptic periods. In this study the author presents the results of analysis of several characteristics of the circulation in natural synoptic periods on the basis of quantitative treatment of the atmospheric circula-

tion. The index of circulation is used to analyze such circulation elements as zonal index $I_{W-E}=c_1\sum_{1}^{i-1}\eta\lambda$, $I_{N+S}=c_2\sum_{1}^{i}m\phi$ and to make these magnitudes equal, $\alpha=\frac{I_{W-E}}{I_{N+S}}$. In these formulas c_1 and c_2 are constants for a given region, $i(j)$ = number of parallels (meridians), $m_N(m_S)$ = number of parallels intersected by isohypses directed from the north (south) to south (north), $\eta_W(\eta_E)$ = number of meridians intersected by isohypses from west (east) to east (west). Indices of circulation were determined for a region between 40° and 72°N latitude and 20°W and 80°E longitude. Curves are presented showing the distribution of (1) indices of zonal circulation (I_{W-E}), (2) indices of meridional circulation (I_{N+S}), (3) the parameter α, and (4) the interperiod variation of the index of zonal circulation (ΔI_{W-E}) for natural synoptic periods. The relationship between zonal circulation in the tendency and in the entire natural synoptic period is very high; the circulation coefficient is $r_\phi=0.9\pm0.02$. From the first ten days it is possible to determine the circulation for the entire natural synoptic period by the equation $y_\phi=0.9x_\phi+9.3$. In the meridional circulation $r_\lambda=0.79\pm0.09$ and the regression equation is $y_\lambda=0.6x_\lambda+54.8$. $y_\phi(y_\lambda)$ = magnitude of the zonal (meridional) circulation in the entire natural synoptic period, and $x_\phi(x_\lambda)$ = value of the index of zonal (meridional) circulation as the tendency of the natural synoptic period. *Subject Headings:* **1. Natural synoptic periods 2. Circulation indexes 3. Long range forecasting.**—*I.L.D.*

11.3–73 551.509.318:551.577.37(571)

Pogosian, Kh. P. and Burtsev, A. I., **Usloviia formirovaniia znachitel'nykh osadkov nad iugom zapadnoĭ Sibiri.** [Conditions for the formation of heavy precipitation over the southern part of western Siberia.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 60:51–64, **1957.** 7 figs., 7 tables, 6 refs., eq. **DWB** (M(055) U581tts)—The most important factors, namely moisture content and vertical mixing of air, in the formation of precipitation over western Siberia are examined on the basis of precipitation data for the period 1943–1954 for various points. The greatest frequency of considerable daily precipitation occurs during the summer months; it is slight in winter. All extensive precipitation is associated with cyclones but in winter even deep cyclones did not suffice, in western Siberia, to bring about extensive precipitation, since the moisture content of air is important in this process in winter. The distribution of precipitation in cyclones varies in winter and summer and from year to year. The trajectories of cyclones giving considerable precipitation in western Siberia involve movement from the northwest to beyond the Urals, movement from the west, and movement from the southwest. Regardless of the trajectory, all the cyclones deepen or regenerate before entering western Siberia. During the winter and transitional months, cyclones yielding considerable precipitation are relatively deep and deepen 5–10 mb in a day before passing through the Urals; while the summer cyclones do not deepen their precipitation is heavier. Extensive precipitation in winter is limited by the small atmospheric moisture content. In order to clarify the process of evolution of heavy precipitation in cyclonic systems and to obtain prognostic indicators the characteristics of the changes of the temperature, pressure and humidity fields were investigated by determining the intensity of temperature and humidity advection, sign and magnitude of vertical atmospheric velocities for various cyclones over Europe and western Siberia. The evolution of a cyclone is divided into three stages: (1) considerable advection of cold air and cooling of air, (2) development proceeds with a general fall of temperature and (3) perceptible diminution in the advective and correspondingly of the adiabatic and total changes of the temperature field. The moisture content of the atmosphere in a cyclone system decreases during the development of the cyclone. A procedure for calculating the precipitation in a cyclone is described and the relevant formula and results of computations are presented. *Subject Headings:* **1. Synoptic conditions for heavy rainfall 2. Western Siberia.**—*I.L.D.*

11.3–74 551.509.318:551.513

*Pshenichnyĭ, A. Ia., **K voprosu o statisticheskikh sviaziakh tipov tsirkuliatsii atmosfery na severnom polusharii.** [Statistical relations between atmospheric circulation types in the Northern Hemisphere.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geog.*, No. 3:77–84, **1956.** fig., 5 tables, 2 refs. **DWB.** Transl. into English by A. Nurklik issued as *Canada. Defence Research Board, Translation*, No. 26, Dec. **1957.** 5 p. 5 tables, etc. Transl. available.

DWB (M13 P974on)—A statistical study of the annual and seasonal frequency duration an succession of the 13 circulation groups (4 basic circulation types) of DZERDZEEVSKIĬ based o 43 yrs of Northern Hemisphere Sea Level weather charts (1899–1941). Meridional circulatio occurs in the U.S.S.R. 89.5% of the time, zonal 8.7% of the time and trans-polar cyclones onl 1.8% of the year. Mean duration is about the same for all groups at all seasons (4 to 4.5 days) Succession of air mass or circulation types is highly correlated with their seasonal frequency— Arctic air succeeds itself most often in winter and warm air advection in summer. *Subjec Headings:* **1. Circulation type frequencies 2. Synoptic climatology 3. U.S.S.R. 4. Northern Hemisphere. I. Nurklik, A.** (*transl.*).—*M.R.*

11.3–75 551.509.318:551.515.23:519.2

*Ryan, P. (*Bureau of Met., Australia*), **Isallobars and extrapolation as aids to prediction of movement.** (In: Tropical Cyclone Symposium, Brisbane, Dec. 1956, **Proceedings,** Pub Dec. **1956.** p. 343–354. 3 refs.) **DWB**—Using the tracks of tropical disturbances for the 1955–1956 tropical cyclone season an evaluation was made of the accuracy of the following forecasting parameters: (a) Bearing and distance of twenty-four hour katallobaric center from disturbance center; (b) Extrapolation of previous twenty-four hour movement; (c) Extrapolation of previous six hour movement; (d) Twenty-four hour isallobaric gradient as applied to: (1) Twenty-four hour direction of movement of the disturbance and (2) Twenty-four hour displacement of the disturbance. The deviation in degrees of the following twenty-four hour direction of movement from the forecast direction using the above parameters was tabulated on a daily basis for eighteen tropical disturbances. The actual displacement was also tabulated on a daily basis as a percentage of the distances between: (e) The twenty-four hour katallobaric center and the disturbance center; (f) The previous twenty-four hour displacement; (g) The previous six hour displacement. The three serious errors found in the use of (a) were studied in detail, and suggestions made for minimizing these errors. *Subject Headings:* **1. Tropical cyclone track forecasting 2. Isallobaric analysis 3. Extrapolation 4. Katallobaric centers.** —*Author's abstract.*

11.3–76 551.509.318:551.524.36:551.524.7:551.547((98)

§Scherhag, R. (*Berlin*), **The role of tropospheric cold-air poles and of stratospheric high-pressure centers in the Arctic weather.** (In: Polar Atmosphere Symposium, Oslo, July 2–8, 1956, **Proceedings, Pt. 1, Meteorology Section.** N. Y., Pergamon Press, **1958.** p. 101–117. 27 figs., table, 9 refs.) Also issued in *Journal of Atmospheric and Terrestrial Physics*, London, Special Supplement, Pt. 1, 1957, pub. **1958.** p. 101–117. **DWB, DLC**—Part of the extensive Arctic atmospheric research conducted the past 3 years by the Meteorological Institute of the Free University of Berlin was concerned with the regions of cold-air poles and stratospheric high pressure centers. Cold poles are originated by lifting processes in the interior of Arctic cyclones and are recognized as the main cold centers of the Northern Hemisphere featuring 500 mb temperature below −30°C in summer, otherwise below −40°C. A method of forecasting the paths of cold lows, based upon investigation of 32 cases, was developed by W. KLUG and is here applied successfully to a characteristic weather situation of May 21, 1954 over northwestern Germany. Several instances of this peculiar stratospheric heating which occurred in Polar regions in the winter of 1951–1952 and in March 1954 are described, accompanied by excellent charts and tabular data. This large-scale phenomenon may be produced by some sort of chain reaction commencing with temperature rise exerting pressure rise aloft and in the final stage strengthens the warm-air advection. Influence on tropospheric weather phenomena is probable but this relationship is the task of future research. *Subject Headings:* **1. Cold poles 2. Stratospheric pressure 3. Arctic cyclones 4. Arctic.**—*W.N.*

11.3–77 551.509.318:551.515.23:551.547.5

Shafer, R. J., **500 mb characteristics of hurricane movement of certain synoptic tests.** (In: Shafer, R. J. et al., **Further studies in the development of short-range weather prediction techniques.** Eastern Air Lines, Inc., Met. Dept., Contract AF 19(604)-2073, Scientific Report, No. 1, April **1958.** p. 26–43. 17 figs.) **DWB** (M09.318 E13sc)—An auxiliary method of determining hurricane direction by classification of 500 mb flow patterns. Certain upper flow patterns seem to predominate during the summer and fall months which do not lend them-

selves to objective application. These are classified as, 1) Total block, 2) Partial block, 3) No block, 4) Cold trough influence, and 5) Special types. Direction of movement is predicted by use of the sea level isobar patterns and by use of the 500 mb steering concept for each of the types. Rules for velocity are given for each type. *Subject Headings:* **1. Hurricane movement forecasting 2. 500 mb flow patterns 3. 500 mb blocks.**—*Author's abstract.*

11.3–78 551.509.318:551.515.23(261)

Shafer, R. J., **30-hour movement of certain Atlantic hurricanes.** (In: Shafer, R. F. et al., **Further studies in the development of short-range weather prediction techniques.** Eastern Air Lines, Inc., Met. Dept., Contract AF 19(604)-2073, Scientific Report, No. 1, April **1958,** p. 1–25. 23 figs., table.) **DWB** (M09.318 E13sc)—An objective method for determining 30-hr movement of hurricanes by use of sea level data over the ocean areas and upper air data over land areas. Motion is described in two components, zonal and meridional. Westerly motion is determined by consideration of the component of the sea level pressure gradient surrounding the hurricane and is opposed graphically by the mean temperature field between 850 mb and 500 mb. The correlation of these parameters is modified by extrapolation and geographic location. Meridional motion is similarly predicted by sea level and thickness parameters modified by extrapolation. The meridional and zonal computation are then combined for the final 30-hr forecast. *Subject Headings:* **1. Hurricane movement forecasting 2. Hurricane forecasting studies 3. Short range hurricane forecasting 4. North Atlantic.**—*Author's abstract.*

11.3–79 551.509.318:551.513:551.543.3

Shishkov, V. G., **O nektorykh zakonomernostiakh v razvitii atmosfernykh protsessov.** [Several regularities in the development of atmospheric processes.] *Meteorologiia i Gidrologiia,* Leningrad, No. 7:12–16, July **1957.** 13 refs. **DWB, DLC**—The author attempts to show the reality of quasistationary waves in the atmosphere by investigating macrosynoptic processes. On a working hypothesis, it was assumed that if quasiperiodic waves in the atmosphere are actually real then they should appear in the rhythm of analogous synoptic processes and in the formation between these analogous processes, of opposite synoptic processes. Natural synoptic periods with verified rhythmic periods of three, four and five months were selected and their frequency was studied regardless of the presence or absence of ultrapolarity in them. Analogousness of the synoptic processes was verified for 150, 75, 90 and 45 days up to the beginning of the natural synoptic period and also after the beginning for the same period over an area extending from the west coast of North America to the Yenisei. The periodicity of three month and five month quasistationary waves is demonstrated; their existence is related to the distribution of continents and oceans. Their value in forecasting is illustrated by means of a few examples. *Subject Headings:* **1. Natural synoptic periods 2. Long waves 3. Quasistationary pressure waves.**—*I.L.D.*

11.3–80 551.509.318:551.513

Shtabova, A. I., **Repernye ul'trapoliarnye protsessy na prostranstve Vostochnoĭ Sibiri i Dal'nego Vostoka.** [Transpolar bench mark processes over Eastern Siberia and the Far East.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy,* No. 56:128–152, **1957.** 7 figs., 4 tables, 5 refs. **DLC**—The author attempts to verify the frequency (according to ±90, ±150, ±45 and ±15 days) of well expressed transpolar processes for the period 1945–1950 and the validity of forecasting indices for transpolar bench mark processes utilized in the Central Forecasting Institute in making 30-day forecasts for Soviet Asia for the period 1952–54. The bench mark transpolar anticyclonic action over Eastern Siberia and the Far East prevails in (1) Taimyr or the Laptev Sea–Central Siberian hoothills; (2) southeast Yakutia-Baikal (most frequently Transbaikal); (3) East-Siberian Sea–Sea of Okhotsk; and (4) basin of the Kolyma River–Sea of Okhotsk. The initial transpolar bench mark processes of the Taimyr, Yakut and east-Siberian groups usually prevail during the winter and only rarely in the warm season; the Kolyma-Okhotsk group occurs only during the warm season (usually in the summer months). The probable occurrence of processes expected on the basis of bench mark indicators is better for three-month than for five-month periods. Initial transpolar processes over Eastern Siberia and the Far East are infrequent. Analogous and opposite processes in relation to the initial

bench mark process are most frequent at ±150, ±90, ±75 and ±45 days from the initial process. The five-month and three-month periods established for the first natural synoptic region can be used also for the second natural synoptic region, and the order of sequence of analogous and opposite processes for the latter corresponds to the pattern of the first natural synoptic region. The validity of bench mark prognostic indicators according to periods varies within limits which permit their practical application. However, the infrequent existence of transpolar bench mark processes indicates that the preparation of monthly forecasts on the basis of bench mark processes is extremely difficult. *Subject Headings:* **1. Transpolar bench mark processes 2. Natural synoptic periods 3. Eastern Siberia 4. Far East.** —*I.L.D.*

11.3–81 551.509.318:551.515.1

§Sidochenko, T. V., **Povtoriaemost' sinopticheskikh protsessov, kharakterizuiushchikhsia izolirovannymi tsiklonami.** [Recurrence of synoptic processes characterized by isolated cyclones.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 56:94–107, 1957. 5 figs., 2 tables, ref. **DLC**—Natural synoptic periods are characterized by isolated cyclones (i.e., cyclones formed initially as partial formations in a trough of an extensive cyclonic system and then becoming separated as a result of the development and destruction of adjoining warm ridges). The process of cyclonic isolation appears on the 500/1000 mb chart both at the earth's surface and in the troposphere in the presence of an independent cold source. The frequency of isolated cyclones in the natural synoptic processes was studied on the basis of 8 years of aerological data from which all cases in which an isolated cyclone was observed both in the troposphere or at the earth's surface in European Russia and Western Siberia. Elementary synoptic processes with isolated cyclones are encountered throughout the year but they are more frequent in the cold than in the warm season. During the winter they are found chiefly in the Central Mediterranean Sea; in the summer they are observed often in the Middle East and central and eastern European Russia. According to geographic positions of isolated cyclones, the natural synoptic periods are divided into 8 types. The synoptic characteristics of each type and their geographic positions are described with the aid of synoptic charts. The period of natural synoptic processes with isolated cyclones is approximately ±90 days; the frequency of processes every ±120 and ±150 days does not differ from their natural probability at any time. The frequency of processes with isolated cyclones and the degree of analogousness of these processes in different regions of the territory examined were investigated by calculating the area over which the signs of pressure fields coincided. This computation was carried out also for processes not analogous to the initial process. Also the forecasting possibilities of the frequency of bench mark processes and their applicability to long range forecasting are considered. *Subject Headings:* **1. Natural synoptic periods 2. Isolated cyclones 3. European U.S.S.R. 4. Western Siberia.**—*I.L.D.*

11.3–82 551.509.318:551.509.33

Takahashi, K.; Okuta, M.; Iida, M. et al., **Classification of 5-day mean 700 mb charts over the East Asia.** *Journal of Meteorological Research*, Tokyo, 9(10):713–720, 6 figs., 9 tables, 3 refs. In Japanese; English summary p. 713. **DWB, DLC**—5-day mean 700 mb anomaly charts have been classified for Far East Asia in a former report. In this report the authors classified 5-day mean 700 mb charts into 20 standard types. The seasonal variation of each type is pronounced, and the persistence is greater than that of 700 mb anomaly types. The weather situation or pressure patterns at the surface is closely connected with mean 700 mb charts, and the distribution of rainfall and the passage of strong cyclones are studied for each type. The zonal index shows the seasonal variation. The 700 mb charts are divided into two types, high and low index types, at about 600 ft/20° lat. of zonal index, but the division between meridional high and low index pattern is not clear as that of zonal indices. The results of our study may be useful in studying the broad scale weather from a given 5-day mean chart. *Subject Headings:* **1. Synoptic types 2. Circulation types over Far East 3. Far East. I. Arai, Y.**—*Authors' abstract.*

11.3–83 551.509.318:551.577.37(47)

*Turketti, L., **Sinopticheskie usloviia vypadeniia extremalnykh osadkov.** [Synoptic conditions of the occurrence of extreme precipitation.] Transl. by Mrs. József Békeffy, from

the original Russian in a 1949 issue of *Meteorologiia i Gidrologiia*, as **Maximális csapadékok kiesésének szinoptikus feltételei,** in *Időjárás*, Budapest, 55(3/4):63–71, March/April **1951.** 4 figs., 4 tables, 3 eqs. **DLC**—A number of cases of extreme precipitation in the European U.S.S.R. was analyzed in respect of synoptic development. The analysis of one of these cases (May 7–8, 1941) is presented in this paper. Data are given in tables and charts on distribution of vertical velocities, surface and upper-air pressure fields, air mass characteristics, upper air winds, and precipitation distribution. The role of each factor in the occurrence of precipitation is discussed and the conclusion reached that it is extremely difficult to account for the relative importance of any of these factors quantitatively. *Subject Headings:* **1. Synoptic conditions for heavy rainfall 2. Synoptic analysis 3. Heavy rainfall 4. Translations 5. U.S.S.R. I. Békeffy, Mrs. József** (*transl.*).—*G.T.*

SHORT RANGE FORECASTING OF SPECIFIC ELEMENTS

WIND

11.3–84 551.509.322:551.553.6(794)

*Dorsch, B. W. and Bankston, L. T., **An objective method of forecasting surface winds at U. S. Naval Ordnance Test Station Inyokern, China Lake, California.** *N. Y. Naval Ordnance Test Station, Inyokern, Technical Memorandum*, No. 289, Oct. 1, **1953.** 83 p. fig., numerous tables.—This report presents a composite of frequency distribution tables relating surface winds at the U. S. Naval Ordnance Test Station, Inyokern, China Lake, California for a given day to early morning winds aloft at NOTS for the same day. The purpose of the tables is to assist NOTS forecasters in making an objective surface wind forecast by giving them a convenient review of past wind situations. These tables summarize the wind data for a five year period at NOTS, 1948 through 1952. An example of how to use the tables is given in the body of the report. *Subject Headings:* **1. Objective forecasting 2. Surface wind forecasting 3. Wind data 4. China Lake, Calif.**—*Authors' abstract.*

11.3–85 551.509.322:551.553.6(729.5,729.71)

Hoose, Harry M. and Levine, Robert (*both, U. S. W. B., San Juan, Puerto Rico*), **Forecasting strong winter winds over Puerto Rico and the Virgin Islands.** *Monthly Weather Review*, Wash., D. C., 86(11):425–434, Nov. **1958.** 9 figs., 8 tables, 3 refs. **DWB, DLC**—Wintertime synoptic situations leading to the occurrence of strong surface winds over coastal waters of the Dominican Republic, Puerto Rico, the Virgin Islands, and the northern Leeward Islands are discussed. Six-hourly average wind speeds for the oceanic areas adjacent to Puerto Rico are obtained from ship reports and related to the surface pressure gradient. The onset of surface winds of 20 kn or greater is found to follow the crossing of the east coast of the U. S. by a migratory anticyclone with above critical central pressure, or the occurrence of strong trade winds above the gradient level at San Juan, P. R., as a nonmigratory anticyclone intensifies. These results are combined into objective forecasting rules for predicting the onset of strong winds 12 to 24 hrs ahead. *Subject Headings:* **1. Strong wind forecasting 2. Puerto Rico 3. Virgin Islands.**—*Authors' abstract.*

11.3–86 551.509.322:551.553.21

Kawanabe, Yasuji, **On the forecasting of the W-ly monsoon in winter.** *Kobe, Japan. Marine Observatory, Memoirs*, 12(1):21–31, Feb. **1958.** 8 figs., 4 tables, 5 refs., 4 eqs. **DWB**—The study of monsoons has been made since olden times but there had been no literature dealing with their forecasting. Past studies depended upon the surface maps and the forecasting period was limited to 24 hrs. After World War II, a rapid development in Japanese observations of monsoons began. Since then remarkable progress has resulted along these lines. The monsoon occurs as a result of reciprocal actions between a deepening cyclone passing through the Japan Sea and a predominant continental anticyclone located near Mongolia. The development of these two factors and a summary of how to make a forecast with a certain degree of accuracy are given. *Subject Headings:* **1. Monsoon forecasting 2. Winter monsoons.** —*N.N.*

11.3–87 551.509.322:551.551.21:551.554

Keast, David N. and Wiener, Francis M., **An empirical method for estimating wind profiles over open, level ground.** *American Geophysical Union, Transactions*, 39(5):858–864, Oct. **1958.** 8 figs., table, 12 refs., 3 eqs. **DWB, DLC**—An analysis of several hundred measured mean wind and corresponding mean temperature profiles has led to an empirical method for estimating wind profiles up to a height of approximately 30 ft above ground cover over open, level ground. This method makes use of two simple measurements: (1) a measurement of the vertical temperature difference between the heights in the range between one foot and 15 ft above ground cover, and (2) a measurement of the horizontal wind speed at a height of about 30 ft or less above ground cover. The mean wind profile is then estimated by means of a contour chart. The limitations and errors involved in the use of this prediction procedure are discussed, and several examples comparing predicted profiles with their measured counterparts are presented. The procedure is proposed for the many practical situations where one wishes to obtain approximate wind profiles over open, level ground with a minimum of instrumentation. *Subject Headings:* **1. Wind profile forecasting 2. Micrometeorological wind profiles.**—*Authors' abstract.*

11.3–88 551.509.322.7:551.513.2:551.557.5

Borisenkov, E. P., **Diagnoz i prognoz polozheniia i intensivnosti struĭnykh techeniĭ.** [The determination and forecasting of the location and intensity of jet streams.] *Meteorologiia i Gidrologiia*, Leningrad, No. 8:21–27, **1957.** 4 figs., 2 tables, ref., 10 eqs. **DLC, DWB**—The results of investigations of the energetics of jet streams and practical methods for analyzing and forecasting them are presented. The kinetic energy in the layer between standard isobaric surfaces was determined by the equation:

$$K_h = \frac{1}{2(p_1 - p_2)} \int_{p2}^{p1} v dp.$$

Its distribution was found to be uneven not only in a direction perpendicular to the axis of the jet but also in the longitudinal direction. From the energetic view point the jet streams are zones of maximum reserves of kinetic energy within which are centers with intensified energy values. The causes leading to the origin (dissipation) of kinetic energy in the atmosphere are analyzed using the equation of energy and the equations for determining the velocity of a center with very high energy (u_s):

$$u_s = c_s + \frac{R}{\dfrac{\partial^2 K_h}{\partial s^2}} \frac{\partial}{\partial s} c_h \operatorname{grad} T.$$

Isotach fields at 500, 300, 200 and 100 mb for the period 1955–1956 were analyzed and the results are presented in a table which gives the mean velocity of distribution of energy centers (in km/12 hrs) and the magnitude of dynamic terms relative to the magnitude of the transferable term in percent. It is shown that the mean velocity of spread of an energy center at all levels is essentially the same and amounts to 900–1000 km/hour. Equations for the calculation of the displacement and a specific example is analyzed. *Subject Headings:* **1. Jet stream forecasting 2. Kinetic energy in atmosphere.**—*I.L.D.*

11.3–89 551.509.322.7(91)

Clarkson, L. S., **Variation with time and distance of high-level winds over Malaya.** *Meteorological Magazine*, London, 87(1,031):143–151, May **1958.** 3 figs., 4 tables, 11 refs. **DWB**—Based mainly on an analysis of the statistical parameters characterizing the distribution and variation with time and distance of radar-observed winds at 40,000 ft and 50,000 ft over Singapore and Songkhla, data is deduced from which future winds at places in Malaya may be predicted by means of a simple regression on the latest Singapore observation. *Subject Headings:* **1. Upper air wind forecasting 2. Statistical analysis 3. Malaya.**—*Author's abstract.*

11.3–90 551.509.322.7:656.7

Harmantas, Louis and Simplicio, S. G. (*both, U. S. W. B., N. Y. International Airport*), **A suggested approach to the problem of providing high-altitude wind forecasts for jet transport**

operations. *American Meteorological Society, Bulletin*, 39(5):248–252, May **1958.** 8 figs., 6 refs. **DWB, DLC**—A technique to provide vertical wind distribution through the mid-latitude (polar) tropopause in the 300- to 200-mb layer is described. Vertical wind-shear charts computed from the horizontal temperature gradients are used to delineate wind variations with altitude in the upper troposphere and lower stratosphere. Examples of vertical wind-shear charts and the suggested operational usages are presented. *Subject Headings:* **1. Upper air wind forecasts 2. Vertical wind distribution 3. Vertical wind shear 4. Jet transport operation.**—*Authors' abstract.*

11.3–91 551.509.322.7:551.557

Kochanski, Adam B., **Some objective methods for forecasting 300-mb and 200-mb winds: a preliminary report.** *U. S. Air Weather Service, AWS Technical Report* 105–136, Nov. **1957.** 14 p. 4 figs., 3 tables. **DWB** (M055 U58a)—Three objective methods of forecasting 300 and 200 mb winds were tested and are found to yield results of an accuracy similar to those of NAWAC forecasts. Their advantage over the NAWAC method is that they require little time and no experience. The three methods tested are: 1) the 50% method (completely objective) which combines a forecast of persistence with a forecast of climatology, 2) the Δh method (semi-objective) in which the climatological thickness for the month is added to an available 500 mb prognostic chart, and 3) the ΔH method (semi-objective) in which the current thickness is averaged with the climatological thickness and the result added to a 500 mb prognostic chart. The best results were obtained by the last named method. *Subject Headings:* **1. Objective wind forecasting 2. Objective forecasting techniques.**—*G.T.*

TEMPERATURE

11.3–92 551.509.323:551.524.31:551.547(421)

Boyden, C. J., **The forecasting of daily mean surface temperature from 1000–500 millibar thickness lines.** *Meteorological Magazine*, London, 87(1030):98–105, April **1958.** 2 figs., 4 tables. **DWB, DLC**—In order to improve the forecasting of daily mean surface temperature, the author investigated the relationship between the mean temperature of the layer between 1000 and 500 mb, which is directly proportional to the thickness of the layer between these two isobaric surfaces, and the mean daily screen temperature (the mean of the maximum at 2100 G.M.T. and the minimum at 0900 G.M.T.). The curve of monthly mean temperatures for Crawley/Larkhill against monthly mean 1000–500 mb thickness for 1948–55 show the presence of two distinct "seasons," namely summer from April to August when the mean temperature was high for the thickness, and "winter" from September to March. The choice of these two seasons is supported by an analysis of the monthly variation of thickness and of the variations of the maximum and minimum lapse rates between the surface and 700 mb temperature. The daily mean temperature for London Airport throughout 1956 plotted against mean of thickness (measured at 0300 and 1500 G.M.T.) at Crawley and a statistical analysis giving root mean square error of daily forecasts of mean temperature and root mean square of 7 day forecast change showed that this method of forecasting the mean temperature for London gave for 1955 a probable error of 2.8°F in winter and 1.8°F in summer. The accuracy of mean temperature forecasts and the verification of such forecasts are discussed and the daily routine of mean temperature forecasts with the aid of 1000–500 mb thickness charts employed at the Central Forecasting Office (England) is described. An appendix containing mean surface temperature at London corresponding to the 1000–500 mb thickness at Crawley is presented. *Subject Headings:* **1. Temperature forecasting from thickness charts 2. London, Eng.**—*I.L.D.*

11.3–93 551.509.323:551.524.32(73)

Enger, Isadore, **Singularities in daily temperatures.** *Journal of Meteorology*, Boston, 16(3):238–243, June **1959.** 2 figs., 3 tables, 7 refs., 4 eqs. **DWB, DLC**—The means of daily maximum temperatures using twenty years of record are obtained. The average of these means over n consecutive calendar days is used as a predictor of the daily maximum temperature one and more years in advance. Data from ten stations in the U. S. for the period 1905

to 1957 are analyzed in this fashion and a series of predictions made for several values of n. If singularities are sufficiently large and persistent, then the averages over only a few days (small n) should be better predictors than averages over a larger number of days. It is found that the prediction errors decrease with increasing n and it is concluded that, whenever averages are used to estimate daily temperature values far in advance, any singularities, even if they exist at all, are much too small to be useful. *Subject Headings:* **1. Temperature singularities 2. Diurnal temperatures 3. N-method 4. Temperature forecasting 5. United States.**—*Author's abstract.*

11.3–94 551.509.323:551.515.23:551.557.2

Kimura, K.; Fujita, T. and Iwato, Z., **On the trajectory around a model cyclone.** *Journal of Meteorological Research*, Tokyo, 5(10/12):774–777, Jan. **1954.** 4 figs. In Japanese; English summary p. 774. **DWB**—The air temperature forecasting at the time of cyclone passage is more or less difficult because of advection effect. In the present paper the authors investigated the trajectory around a model cyclone with certain pressure distribution and moving velocity. The trajectory obtained as such is useful to determine the history of air particle under consideration and also to forecast air temperature more correctly. *Subject Headings:* **1. Cyclone dynamics 2. Temperature forecasting in cyclones 3. Air trajectories 4. Cyclone models.**—*Authors' abstract.*

11.3–95 551.509.323:551.524.36(768)

Kleinsasser, Theodore W. and Younkin, Russell, J. (*both, W. B. Airport Station, Knoxville, Tenn.*), **Application of the heat balance approach to maximum temperature forecasting.** *Monthly Weather Review*, Wash., D. C., 86(5):165–170, May **1958.** 5 figs., 6 tables, 3 refs. **DWB**—The daily net energy available for heating the air from 0300 G.M.T. to the following afternoon, as determined by MAYERS, is used to compute objectively the maximum temperature expected under static, clear-sky conditions at 12 cities in the power distribution area of the Tennessee Valley Authority. The maximum temperatures thus obtained are plotted and analyzed to resolve irregular features of the isotherm patterns. The analysis is then adjusted subjectively—primarily for the effect of temperature advection but also for cloudiness, precipitational cooling, and vertical motion—to take account of changes expected by mid-afternoon of the current day and also of the following day. Verification results for seven cities in the TVA area during 1954 and 1955 are presented. The current-day forecast errors are approximately 50% less than persistence forecast errors. *Subject Headings:* **1. Maximum temperature forecasting 2. Heat balance 3. Tennessee.**—*Authors' abstract.*

11.3–96 551.509.323(718)

Mackay, G. A. (*Met. Service, Winnipeg, Manitoba*), **Method of temperature prediction.** *Royal Meteorological Society, Canadian Branch*, [*Publication*], 7(3), June 1, **1956.** 4 p. 3 figs., table, 7 refs. **DWB**—Sample nomograms for Jan. and July maximum temperature prediction and for January minimum temperature prediction at Gander, Newfoundland, based on 3000 sets of data which have been processed and smoothed (to produce nomograms for each month of the year for both maximum and minimum temperature). Thickness of 1000–850 mb layer was considered to be the most worth-while (and most conservative) parameter tested. Percent transmission of insolation by clouds of each type in each month is second parameter. Air mass dew point at 1830 G.M.T., and geostrophic wind direction and speed the 3rd and 4th parameter used. Sea breeze effects at coastal places (.92 correlation with thickness) and deeper layers (1000–700 mb) in interior of continent are considered. Accuracy is discussed. *Subject Headings:* **1. Objective temperature forecasting 2. Nomograms 3. Gander, Newfoundland.**—*M. R.*

11.3–97 551.509.323:551.524.36(94

Maine, R. (*Bureau of Met., Adelaide*), **Maximum temperature prediction.** *Australian Meteorological Magazine*, Melbourne, No. 22:50–63, Sept. **1958.** 2 figs., table, 11 refs., 2 eqs. **DWB**—A set of 74 January daily maximum temperatures at Adelaide, South Australia, can be shown to correspond with reasonable precision to an empirically predicted set based on three homogeneous governing parameters available at 6 a.m. local time. Selection of governing

parameters is accomplished statistically. *Subject Headings:* 1. **Maximum temperature forecasting 2. Adelaide, Australia.**—*Author's abstract.*

11.3–98 551.509.323:551.524.36

Mashkovich, S. A. and Kheĭfets, Ia. M., **Opyt sostavleniia operativnykh prognozov srednemesiachnoĭ anomalii nazemnoĭ temperatury po metodu E. N. Blinovoĭ.** [Trial preparation of operational forecasts of monthly mean surface temperature anomaly using E. N. Blinova's method.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 60:37–43, **1957.** table, ref., 31 eqs. **DWB** (M(055) U581tts). Transl. into Eng. by A. Nurklik issued as *Canada. Meteorological Branch, Meteorological Translations*, No. 2:22–31, **1959.**—E. N. BLINOVA's method of forecasting the monthly mean surface anomaly of temperature used in the section on Dynamic Meteorology of the Central Institute of Forecasting and the verification of such forecasts are presented. From the point of view that the atmospheric motion can be regarded as a disturbance imposed upon a zonal flow the nonstationary and nonzonal part of the function of flow ω'' satisfies the following differential equation

$$\left(\frac{\partial}{\partial t}+\alpha\frac{\partial}{\partial\lambda}\right)\Delta\psi''+2(\alpha+\omega)\frac{\partial\varphi''}{\partial\lambda}=0$$

the solution of which is

$$\psi''=\sum_n\sum_m\left[C_n^m\cos\left(m\lambda+\sigma_n^m t\right)+D_n^m\sin\left(m\lambda+\sigma_n^m t\right)\right]P_n^m\left(\cos\theta\right)$$

where θ = complement to latitude; λ = longitude of the place; t = time; ω = angular velocity of the earth's rotation; α = angular velocity of the earth's rotation relative to the earth (α/ω = circulation index); C_n^m and D_n^m = coefficients expressed through coefficients of resolution of the initial 500 mb geopotential field in a series of spherical functions; and $P_n^m(\cos\theta)$ = added Legendre polynomial

$$\sigma_n^m=-m\alpha+\frac{2m(\alpha+\omega)}{n(n+1)}.$$

The nonzonal, nonstationary part of the temperature T'' satisfies the equation

$$\left(\frac{\partial}{\partial t}+\alpha\frac{\partial}{\partial\lambda}\right)T''-\frac{k''}{a^2}\Delta T''-\frac{\partial}{\partial z}\left(k'\frac{\partial T''}{\partial z}\right)=\frac{1}{a^2\sin\theta}\frac{d\bar{T}}{d\theta}\frac{\partial\psi}{\partial\lambda}$$

where k' = coefficient of turbulent temperature conduction vertically; k'' = coefficient of horizontal large scale mixing; a = radius of the earth; z = geometrical height; Δ = two dimensional Laplace operator in spherical coordinates; T = zonal temperature distribution regarded as known and equal to $T=\bar{T}_0+M\sin^2\theta$. The equation is solved for various initial and limiting conditions. The formula for long range temperature forecasting

$$T''=\sum_{n=1}^{\infty}\sum_{m=1}^{n}\left[T_{1n}^m(Z,\theta)\cos\left(m+\lambda+\sigma_n^m t\right)+T_{2n}^m(Z,\theta)\sin\left(m\lambda+\sigma_n^m t\right)\right]$$

is rewritten in the form

$$\begin{aligned}T''(\theta,0,t)&=\sum_{n=1}^{\infty}\sum_{m=1}^{n}\left\{T_{1n}^m\cos\left(m\right)+\sigma_n^m t\right)+T_{2n}^m\sin\left(m\lambda+\sigma_n^m t\right)\}\\&=\sum_n\sum_m\left\{T_{1n}^m\left(\cos m\lambda\cos\sigma_n^m t-\sin m\lambda\sin\sigma_n^m t\right)\right.\\&\left.+T_n^m\left(\sin m\lambda\cos\sigma_n^m t+\cos m\lambda\sin\sigma_n^m t\right)\right.\\&=\sum_m\cos m\lambda\sum_n\left(T_n^m\cos\sigma_n^m t+T_{2n}^m\sin\sigma_n^m t\right)\\&\qquad+\sum_m\sin m\lambda\sum_n T_{2n}^m\cos\sigma_n^m t-T_{1n}^m\sin\sigma_n^m t.\end{aligned}$$

This formula is transformed into a form for computing directly the forecast of monthly mean temperature namely

$$T = \frac{1}{N}\int_a^{a+n} T''dt = \frac{2m}{a^2(\alpha+\omega)} \{ \sum_m \cos m\lambda \sum_n (C_n{}^m Z_{1n}{}^m - D_n{}^m Z_{2n}{}^m) + \sum_m \sin m\lambda \sum_n (D_n{}^m Z_{1n}{}^m + C_n{}^m Z_{2n}{}^m) \}$$

The computation for latitude at given points of longitude is

$$T = \frac{2M}{a^2+(\alpha+\omega)} \Sigma_{am}(\theta) \cos m\lambda + b_m(\theta) \sin m\lambda.$$

A comparative table giving the forecasts made over a period of four years for the monthly mean anomaly of surface temperature in the U.S.S.R. in percent is presented. *Subject Headings:* **1. Monthly mean surface temperature anomaly forecasting 2. Temperature anomaly forecasting 3. Blinova's method. I. Nurklik, A.** (*transl.*).—*I.L.D.*

11.3–99 551.509.3233

Palmieri, Sabino and Todaro, Casimo, **Sulle previsioni di temperatura.** [On the forecasting of temperature.] *Rivista di Meteorologia Aeronautica*, Rome, 19(2):33–38, April/June, **1959.** 2 figs., 3 tables, 3 refs. English summary p. 33. **DLC**—The correlation between a parameter bound to the apparent advection of temperature at 850 mb and the following thermal changes at the same level and at surface are examined. Considerations of interest for forecasts are drawn therefrom. A typical case, in which convergence phenomena have a predominant importance, is then described. *Subject Headings:* **1. Temperature forecasting 2. Advective temperature change.**—*Authors' abstract.*

11.3–100 551.509.323:551.547:551.524.36(439.1)

Rákóczi, Ferenc, **Az 500/1000 mb-os relatív geopotencial kapcsolata a napi hőmérséklêti maximummal derült napokon.** [Relation of the 500/1000 mb relative geopotential with the diurnal maximum temperature on clear days.] *Időjárás*, Budapest, 61(6):419–423, Nov./Dec. **1957.** 3 tables, 3 refs., 3 eqs. German and Hungarian summaries p. 419. **DLC**—Data for Budapest are analyzed as to a relation between 500/1000 mb relative topography and daily maximum temperature on clear or quasi-clear days. It is found that the regression equation obtained permits maximum temperature forecasting with adequate accuracy on the basis of radiosonde observations in the early morning. *Subject Headings:* **1. Relative topography 2. Maximum temperature forecasting 3. Relative topography-maximum temperature relationships 4. Budapest, Hungary.**—*Transl. of author's abstract.*

11.3–101 551.509.323:551.555.6:551.515.8(52)

§Saito, N., **On the analysis of cold wave in Jan. 1954 and the technique of forecasting of cold outbreak.** *Journal of Meteorological Research*, Tokyo, 8(6):343–353, July 1956. 11 figs., table, 10 refs. In Japanese; English summary p. 343. **DWB, DLC**—This synoptic study of weather development preceding and accompanying a cold-air outbreak over Japan includes 700 mb charts illustrating the general circulation in Jan. 1954, a qualitative formula for predicting the position of a long wave at the time of its deepening, and an analysis of blocking phenomena over the Pacific Ocean between Jan. 16 and 20. *Subject Headings:* **1. Cold waves 2. Cold air outbreaks 3. Cold wave forecasting 4. Japan.**—*Author's abstract.*

11.3–102 551.509.323:551.524.36(792)

Williams, Philip, Jr. (*U. S. W. B., Salt Lake City*), **An objective method of forecasting maximum temperatures at Salt Lake City, Utah.** *American Meteorological Society, Bulletin*, 39(4):202–204, April **1958.** 2 figs., table, 3 refs. **DWB, DLC**—An objective method is developed for forecasting the current day's maximum temperature at Salt Lake City during the warm season, May–October. Good results are obtained by using either the height of the freezing level or the 700 mb temperature at 0800 M.S.T. at Salt Lake City combined with

the 0830 M.S.T. surface temperature and the 0530–0830 M.S.T. surface temperature change. Results are compared with subjective forecasts. *Subject Headings:* **1. Objective forecasting 2. Maximum temperature forecasting 3. Salt Lake City, Utah.**—*Author's abstract.*

11.3–103 551.509.323:551.524.35(47)

§Zgurko, V. B., **Preemstvennost' sinopticheskikh protsessov, privodiashchikh k rezkim ponizheniiam temperatury na Evropeĭskoĭ territorii SSSR.** [Sequence of synoptic processes leading to sudden temperature drops in European U.S.S.R.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 65(127):27–40, **1956.** 14 figs., 2 tables. **DLC**—The author demonstrates that the sequence of transpolar and meridional processes producing marked cooling in European U.S.S.R. does not depend upon the months taken as the beginning of reckoning. The following sequence holds for transpolar processes:

−3	−2	−1	0	+1	+2	+3
normal	normal	meridional	transpolar	transpolar	meridional	transpolar

for meridional processes:

−3	−2	−1	0	+1	+2	+3
normal	normal	transpolar	meridional	meridional	meridional	meridional;

here −1, −2, −3 are preceding months; +1, +2, +3 are succeeding months and 0—initial month. The transpolar and meridional processes observed in December and January occur also in other months. Synoptic maps showing the succession of transpolar and meridional processes associated with marked cooling and a table of transpolar processes for December are presented. *Subject Headings:* **1. Synoptic conditions for cold waves 2. Temperature drop 3. European U.S.S.R.**—*I.L.D. and author's conclusion.*

11.3–104 551.509.323:551.555.6:551.515.8(47)

Zgurko, V. B., **Preemstvennost' sinopticheskikh protsessov, privodiashchikh k sil'nym pokholodaniiam.** [Sequence of synoptic processes leading to strong cooling.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 70:109–134, **1957.** 8 figs., 8 tables, 9 refs. **DLC**—In order to find out the sequence of ultrapolar synoptic processes leading to sharp temperature drops in Moscow and the rest of European U.S.S.R., and to determine the possibility of forecasting them, a detailed study of a large number of such processes starting in October, November, December, and January, in the years 1898–1938, both ultrapolar (from northeast to southwest) and meridional has been carried out. The results of the study show that the sequence of the processes remains unchanged regardless of the month of their beginning, and that it is possible to forecast the type of processes that will take place (with ±2 days tolerance) as well as the regions that will be enveloped by the cold wave. *Subject Headings:* **1. Synoptic conditions for cold waves 2. Cold wave forecasting 3. European U.S.S.R.**—*A.M.P.*

FROST

11.3–105 551.509.323.2:551.524.37(234.9)

Bialynitskaia, V. G. and Ped', D. A., **Tsirkuliatsionnyĭ sposob prognoza zamorozkov v mae na Severnom Kavkaze.** [Method of predicting frosts during May in the northern Caucasus on the basis of the circulation.] *Meteorologiia i Gidrologiia*, No. 9:29–31, Sept. **1956.** 3 tables, ref., 3 eqs. **DWB, DLC**—The authors analyzed the atmospheric fronts which occurred in May in the northern Caucasus over the interval 1938–1955 in relation to meridional flow, frontal zones and advective flow. In order to take into account the extent of its meridional to tropospheric field, an index of the meridional circulation was determined by the following formula:

$$I = \frac{b \sum_{1}^{j-1} k_{\varphi} m_{\varphi}}{(\lambda_i - \lambda_1)(j-1)}$$

where I = northerly index of the meridional circulation (decameter per 1° equator), b = magnitude of the geopotential (in decameters), through which isohypses are drawn, j = number of

parallels in the area examined, $m\varphi$ = number of parallels intersected by isohypses directed from the north, $k\varphi = 1/\cos\varphi$, a corrected coefficient constant for each latitude; it shows the relationship of the length of an arc of 1″ of the equator to the length of an arc of 1″ on each parallel, i = number of meridian passing through the area examined, λ = longitude. This formula is simplified into

$$I = c \sum_{1}^{i-1} m\varphi \quad (c = \text{const}).$$

A central circulation index is calculated for the occurrence of atmospheric frosts in this area. *Subject Headings:* **1. Frost forecasting formulas 2. May frosts 3. Northern Caucasus, U.S.S.R.**—*I.L.D.*

11.3–106 551.509.323.2:551.524.36(52)

Kobayashi, Y., **Forecasting of the distribution of minimum air temperature at the time of late frost.** *Japan. Meteorological Agency, Tokyo, Memoirs of Industrial Meteorology*, 22(1):9–13, **1958.** 5 figs., 2 tables, 2 refs., eqs. In Japanese; English summary p. 13. **DLC.** Reprinted in *Sendai, Japan. Central Meteorological Observatory, Journal of Meteorological Research of Tohoku District*, Vol. 12, Memoir No. 10, March **1959.** 5 p. 5 figs., 2 tables. In Japanese; English summary [p. 13]. **DWB**—The distribution of minimum air temperature is forecast by calculation from the distribution of air temperature at 18 o'clock on the day before, and the formulas adopted are as follows:

$$\Delta T_{N0} = t_0 - T_0 \text{ (for Fukushima)},$$

and

$$\Delta T_{Ni} = t_i - T_i \text{ (for other stations)},$$

where t_0 and t_i are air temperatures at 18 o'clock on the day before, and T_0 and T_i minimum air temperatures.

$$C_i = \frac{\Delta T_i}{\Delta T_0}$$

$$T_i = t_i - C_i \Delta T_0$$

C_i-charts in the cases of *E*, *EO* and *O* (distribution types of horizontal temperature deviation) are given in the figures. The distribution of observed and calculated values of minimum air temperature, and the distribution of $\epsilon = (T_i)ob - (T_i)ca$ are shown in the figures. *Subject Headings:* **1. Minimum temperature forecasting 2. Late frosts 3. Frost forecasting 4. Japan.**—*Author's summary.*

11.3–107 551.509.323.2:551.506.7(52)

Maeda, H., **On the late frost in the Reinan Region, Fukui Prefecture, Pt. 2.** *Japan. Meteorological Agency, Memoirs of Industrial Meteorology*, 21(2):75–81, **1958.** 7 figs., table, 3 refs. In Japanese; English summary p. 81. **DWB**—In the present paper the author deals with the forecasting of late frost in the Reinan Region, in the southwestern part of Fukui Prefecture. The results obtained are as follows: The relation between the minimum air temperature and the minimum grass temperature at Tsuruga can be represented by a linear equation

$$Y = 1.0X - 2.5$$

where X = minimum air temperature, and Y = minimum grass temperature. Therefore, when the minimum air temperature falls below 2.5°C, frost may occur. The occurrence of frost in mountainous regions of the Prefecture can be forecast by the use of the relation between the minimum air temperatures of Tsuruga and Mikata (situated in a mountainous region.) The relation between the minimum air temperatures at Tsuruga and Mikata can be represented by a linear equation

$$Y = 0.8X + 0.1$$

where X = minimum air temperature at Tsuruga, and Y = mininum air temperature at Mikata. Therefore, when the minimum air temperatures at Tsuruga falls below 3.0°C, mountainous

places are threatened with frost. The author then classifies the weather charts of migratory-anticyclone type and deals with the characteristics of frosty type and nonfrosty type with the use of the aerological data of Wajima Weather Station for that time. The author thus understands that the occurrence of frost in the Reinan Region can be forecast at 0 h 00 m of the day preceding the frosty night with the use of the aerological data of Wajima Weather Station. *Subject Headings:* **1. Frost forecasting 2. Reinan Region, Japan.**—*Author's abstract.*

11.3–108 551.509.323.2:551.524.37(52)

Nakano, T., **On the late frost in Toyama District.** *Japan. Meteorological Agency, Tokyo, Memoirs of Industrial Meteorology*, 21(1):5–8, **1957.** 7 figs. In Japanese; English summary p. 8. **DLC**—In this paper, the author investigates the relation of late frost and meteorological conditions in Toyama Prefecture. Main results are as follows: (1) The relation of late frost and pressure pattern are shown by Table 1, Figs. 2 and 3. (2) The air temperature at 18h (T_{18}) and the dew point temperature at that time (T_{d18}) are closely related. $T_{18}-T_{d18}$ is proportional to the difference between T_{18} and the next morning minimum temperature. *Subject Headings:* **1. Late frosts 2. Toyama Prefecture, Japan.**—*Author's abstract.*

11.3–109 551.509.323.2:551.524.37(497.1)

Penzar, Ivo (*Geofizički Institut, Prirodoslovno-Matematičkog Fak., Grič 3, Zagreb*), **Prilog prognozi mraza u našim krajevima.** [Contribution to frost forecasting in Croatia.] *Zagreb, Yugoslavia. Hidrometeorološki Zavod NR Hrvatske, Rasprave i Prikazik*, 8(1), **1957.** 13 p. table, 16 refs. English summary p. 12–13. **DWB** (M09.323.2 P419pr)—Formulas for predicting morning temperature minima from maximum temperature and dew point readings made during the previous afternoon are discussed and tested against data for several places in Croatia for 3 or 4 yrs. Different relations are found for relative humidity $\geq 40\%$ and $\leq 39\%$, and for April–September than for October–March, so four equations are presented, two for the cold season and two for the warm season for each of the 5 places tested. A nomogram for calculating the dewpoint from the maximum temperature and humidity is included. The tests show predicted minima generally 1–2°C lower than the actual, for frost forecasts issued at 4 p.m. *Subject Headings:* **1. Frost forecasting in Croatia 2. Croatia, Yugoslavia.**—*M.R.*

CLOUD TYPE, AMOUNT AND LEVEL

11.3–110 551.509.324.1

Baroni, Andrea, **Le nubi alte e la loro previsione.** [High clouds and their forecasting.] *Rivista di Meteorologia Aeronautica*, Rome, 19(1):29–34, Jan./March **1959.** photo, 17 refs. Italian, French, English and German summaries p. 29. **DLC**—The increasing importance that high clouds are acquiring in connection with high altitude flying is emphasized, and recent results gained in investigating those clouds are here briefly reviewed. *Subject Heading:* **1. High level cloud forecasting.**—*Author's abstract.*

11.3–111 551.509.324.1

Baroni, Andrea, **Alcune regole per la previsione delle nubi alte.** [Some rules for the forecasting of high clouds.] *Rivista di Meteorologia Aeronautica*, Rome, 19(2):39–44, April/June, **1959.** 17 refs. Eng. summary p. 39. **DLC**—A few rules are here formulated to forecast the formation of high clouds, based on experimental results obtained by various authors. These rules are taken into consideration by groups, keeping in mind the various meteorological parameters. *Subject Heading:* **1. High level cloud forecasting.**—*Author's abstract.*

11.3–112 551.509.324.1:551.576.11

†Buz, A. I., **K voprosu o prognozirovanii vremeni nachala obrazovaniia kuchevykh oblakov.** [Problem of forecasting the time of the beginning of cumulus cloud formation.] *Lietuvos TSR Mokslų Akademija. Geologijos ir Geografijos Institutas, Moksliniai Pranešimai*, Vol. 3, Geofizika, Hidrologija, issued Vilna, **1956.** p. 99–104. table, 11 refs.—The author summarizes various hypotheses on the formation of cumulus clouds and concludes that none is satisfactory; neither explanations involving the condensation of moisture in ascending vertical currents nor turbulence are adequate. On the assumption that the development of cumulus clouds

begins during the establishment of an almost dry adiabatic temperature gradient in the lowe layer of the atmosphere, the author computed the temperature at which cumulus clouds begi to form. On the aerological graph constructed from morning radiosonde data, the temperatur at which cumulus clouds begin to form was computed by determining the point of intersectio of a dry adiabat with the surface isobar. The difference between computed and actual tem perature of cumulus formation is explained by the warming of the upper atmospheric layer which reduces the vertical temperature gradient and by the fact that initiation of convectio provides parcels of air that are superheated in comparison with the air in the instrument shelte where temperature is measured. In order to forecast the time of beginning of cumulus forma tion the following procedures are outlined, namely: (1) determination of the temperature c cumulus formation by extrapolating the dry adiabatic stratification to the isobar at the earth' surface on an aerological diagram constructed from morning soundings; (2) computation c degree of warming (computed minus actual temperature); (3) determination by a graph c rate of temperature rise as a function of soil temperature; (4) computation of time of warmin and time of beginning of cumulus formation. An example of the computation of time c cumulus formation is presented. *Subject Headings:* **1. Cumulus cloud forecasting 2. Cumulu cloud formation.**—*I.L.D.*

11.3–113 551.509.324.1:551.576.1

Shishkin, N. S., **Ispol'zovanie metoda sloia dlia prognoza vertikal'noĭ moshchnosti kon vektivnykh oblakov,** [Use of the layer method in forecasting the vertical development o convective clouds.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 54(116) 96–103, **1955.** 2 figs., 2 charts, 6 refs., 5 eqs. **DLC**—The layer method contains criteria fo the development of convection which can be used to forecast the vertical thickness of convective clouds. The formula for the criteria of convection given by the author is

$$\Delta H \rho S_d(\gamma - \gamma_m) - \Delta H \rho S_m(\gamma_d - \gamma) > 0$$

where S_m and S_d = area of clouds and of cloud intervals in fractions of one (or both), γ_d, γ_m = dry and moist adiabatic temperature gradients. The procedure for calculating the maximum possible vertical thickness of convective clouds on the basis of morning soundings is outlined The forecasting of convective precipitation and thunderstorm phenomena is discussed. A procedure for forecasting the vertical thickness of convective clouds for different amounts o cloudiness with the aid of the above formula is developed. A form for computing the vertica thickness of convective clouds is presented. *Subject Headings:* **1. Convective cloud structure 2. Cloud thickness forecasting 3. Layer method.**—*I.L.D.*

11.3–114 551.509.324.1

Sloane, Eric, **You can forecast weather by the clouds.** *Popular Mechanics Magazine*, Chicago, 109(3):112–120, 226, March **1958.** illus. (in color). **DWB**—Beautiful colored full page schematic cloud photographs illustrate the practical value of cloud observation fo forecasting weather, cumulus, cold front and warm front cloud structures. Other signs (anomalous, acoustical or optical occurrences, no dew, sunset colors, halos, general easterly motion of thunderstorms in U. S.) and rules are indicated. *Subject Headings:* **1. Cloud type forecasting 2. Amateur forecasting.**—*M.R.*

PRECIPITATION

11.3–115 551.509.324.2(945)

Clarke, R. H. (*C.S.I.R.O., Div.of Met. Physics, Melbourne*), **Some observations on spring rainfall at Melbourne.** *Australian Meteorological Magazine*, Melbourne, No. 20:39–60, March **1958.** 6 figs., 4 tables, 3 refs. **DWB**—In an attempt to explore the possibility of issuing quantitative daily precipitation forecasts, some statistical relations between daily rainfall and certain "predictors"—upper winds at two levels, vertical stability and humidity distribution and frontal passages—have been derived, based on September to November data for the years 1953–56 inclusive. This study indicates that the value of these "predictors" for the quantitative forecasting of rainfall is limited. *Subject Headings:* **1. Rainfall forecasting 2. Melbourne, Australia.**—*Author's abstract.*

11.3–116 551.509.324.2(52)

Fujiwara, S. et al., (*all, Japan Met. Agency, Tokyo*), **Forecasting of precipitation pattern of small scale.** *Meteorological Society of Japan, Tokyo, 75th Anniversary Vol. of the Journal,* pub. Nov. **1957.** p. 304–308. 3 figs., 3 tables, 2 refs. **DWB, DLC**—As a first attempt to establish a quantitative method of predicting the small scale rainfall pattern, the effect of topography is investigated in detail based on the numerical prediction method. The calculation is carried out by dividing the atmosphere into two layers; one above 850 mb, the other below it. The vertical velocity for the upper layer is computed by the ω-equation under the assumption that the vertical distribution of ω is parabolic. For the lower layer, only the vertical motion due to the orographic effect is considered. By multiplying the water vapor condensation function by these vertical velocities and summing up the results, the amount of rainfall at the ground surface is calculated. Grid distances used for the calculation are 300 km for the upper layer and 10 km for the lower layer respectively. The method is tested for the case of typhoon "Kitty" which passed over Kanto District from Aug. 31 to Sept. 1, 1949. The result is satisfactory as far as the general feature of the distribution of rainfall is concerned. But the correlation coefficient between 24 hr forecast and the observed amount of rainfall is 0.63 and indicates that the result is not satisfactory yet. To get better results, the effects of surface friction and of isallobaric wind should be considered. *Subject Headings:* **1. Precipitation pattern forecasting 2. Numerical forecasting 3. Typhoon "Kitty" (1949) 4. Japan.**—*Authors' abstract.*

11.3–117 551.509.324.2:551.577.37

†Gibbs, W. J., **The rain process.** (In: Australia. Bureau of Meteorology, **Conference on estimation of extreme precipitation, Melbourne, April 1958.** Melbourne, Dec. **1958.** p. 10–56. 23 figs., 6 tables, 22 refs., 15 eqs.) **DWB** (M77.31 C748c)—A review of the present knowledge of the physics of clouds and precipitation leads to the conclusion that moisture content, degree of saturation and vertical motion are the primary factors in determining precipitation intensity. In the case of precipitation from convective processes the entrainment of unsaturated environmental air will reduce precipitation intensity. It seems likely that sufficient condensation nuclei are always present for the promotion of the precipitation process. An examination of actual synoptic situations encourages the belief that the use of models could be of advantage in precipitation forecasting. It is concluded that the development of quantitative rainfall forecasting techniques and the improvement of methods of making statistical estimates of rainfall are possible but must be based on a sound knowledge of the physics of the rain process and sound statistical principles. It is also concluded that further research is required into the vertical motion associated with convective and synoptic systems, the prognostication of these systems and the statistical techniques used in the analysis of rainfall data. *Subject Headings:* **1. Precipitation forecasting 2. Cloud physics 3. Precipitation intensities.**—*Author's abstract.*

11.3–118 551.509.324.2:551.509.317

Hilworth, J. T., **Type of precipitation forecast—winter.** Eastern Air Lines, Inc., Met. Dept., Contract AF 19(604)-2073, Scientific Report, No. 1, April **1958.** p. 158–169. 5 figs., 3 graphs. **DWB** (M09.318 E13sc)—The first section of this study presents a solution to the problem of forecasting the type of precipitation and the location with respect to the synoptic system. The basic parameters are the wet bulb temperature at surface or 1000 mb level and at 850 mb level. Also in this section some basic rules for moving isotherms and dewpoint lines at 850 mb are stated. The second section of this study is devoted to a discussion of a method of location of the area of maximum snowfall. Four distinct types of major snowstorms are discussed and illustrated. A method of locating and forecasting the area of maximum snowfall is presented using the charts at the 850 mb and 700 mb levels. *Subject Headings:* **1. Precipitation type forecasting 2. Maximum snowfall area forecasting.**—*Author's abstract.*

11.3–119 551.509.324.2:551.501.81(795)

Hunsucker, Robert D., **The utilization of weather radar reflecting layer data in forecasting changes in precipitation.** (In: Decker, Fred W. et al., **Instrumentation and techniques for Army weather observation.** Oregon State College, Corvallis, Dept. of Physics, Contract

DA-36-039 SC-73186, 5th Quarterly Technical Report, **1958.** p. 16–22. 3 tables, 13 refs. **DWB** (M01 O66i)—This report stresses the importance of utilizing meteorological information regarding the vertical structure of the precipitation, in conjunction with the information on the aerial extent, movement, and intensity of precipitation echoes obtained from the PPI presentation of a weather radar installation. The results of a series of radar observations made at Corvallis, Oreg. in the winter of 1957–1958 is given in this material. The investigation used a low power 3.2 cm vertically scanning radar (AN/APS-4) along with synoptic data in forecasting changes in precipitation. *Subject Headings:* **1. Precipitation forecasting 2. Weather radar data 3. Corvallis, Oregon.**—*N.N.*

11.3–120 551.509.324.2:551.588.2(522

Ishihara, K.; Noguchi, T.; Sugiura, S. et al. (*all, Japan Met. Agency, Tokyo*), **Forecasting of precipitation on the small scale, Pt. 1.** *Geophysical Magazine*, Tokyo, 28(1):21–43, Aug. **1957.** figs., tables, 6 refs., 22 eqs. Also in: *Journal of Meteorological Research*, Tokyo, 9(9):615–632, Sept. **1957.** 16 figs., 7 tables, 6 refs. In Japanese; English summary p. 615. **DWB, DLC**—In Japan, a country with complicated topography, small scale forecasting for an area of several hundreds to several thousands of square kms is indispensable for flood protection, water supply for hydroelectricity, and irrigation projects. As the first step for establishing the method of small scale quantitative rainfall forecasting, the effect of topography on rainfall is investigated in detail in conjunction with research on quantitative rainfall forecasting based on the numerical prediction method. In this study the atmosphere is divided into two layers, one above 850 mb, the other below it, and vertical velocities for each layer are computed under the assumptions of the dynamical vertical motion model of synoptic pattern for the upper layer and topographical vertical motion model for the lower layer. Multiplying the water vapour condensation function by these vertical velocities, the amounts of rainfall for each layer are obtained, and adding them the rainfall amount observed on the surface is obtained. For the computation of the vertical velocity of the upper layer, the numerical prediction method is applied. The computer used is a relay computer and the mesh size is 300 km. In the lower layer, using a 10 km mesh size, topographical vertical velocity is computed. The method is applied to typhoon "Kitty" which passed over Kanto District from Aug. 31 to Sept. 1, 1949. The result obtained is satisfactory in the distribution, but from the quantitative point of view, as the correlation coefficient of 24 hourly computed and observed rainfall amount indicates 0.63, it is not satisfactory. To get better results the effect of friction, isallobaric wind, etc. must be considered. *Subject Headings:* **1. Rainfall forecasting 2. Local precipitation forecasting 3. Topographic influences 4. Japan. I. Fujiwara, S. II. Fukui, A. III. Hata, K. IV. Tsuchiya, K.**—*Authors' abstract.*

11.3–121 551.509.324.2:551.578.4(52)

Nagata, M. and Tsuchitaka, S., **On the prediction of snowfall at Toyooka.** *Journal of Meteorological Research*, Tokyo, 8(11):723–725, Dec. **1957.** 7 figs., 2 tables. In Japanese. **DWB, DLC**—The statistical analysis shows that snowfall in Toyooka tends to increase as the air temperature of the 200 mb layer in Yonago falls below −15°C. Relation between continual duration of snowfall and snow cover depth is empirically determined. Forecasts of snowfall and snow cover depth are studied by synoptic analysis of discontinuity line in Toyooka. *Subject Headings:* **1. Snowfall forecasting 2. Toyooka, Japan.**—*Jay Woo.*

11.3–122 551.509.324.2:551.577.37:551.515.2(52)

†§Omoto, Y. (*Dept. of Physics, Hokkaido Univ.*), **A case study of a series of showers.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 34(2):95–103, May **1956.** 10 figs., 20 refs. **DWB, DLC**—Analysis of the series of showers which passed over Hokkaido on Sept. 11 and 12, 1954. The series of showers consisted of about 25 cells or "R regions" and resulted in 5 narrow parallel strips of heavy precipitation. All showers moved in the same direction (ENE) at 70 km/hr. A low level jet stream over the area is analyzed and surface synoptic charts, cross sections, histograms, pluviograph records and recorder records of pressure, temperature, precipitation and wind speed at Otaru and Sappora are presented. The precipitation occurred at a time when an intense typhoon—"June"—was approaching Kyushu; however, the pre-

cipitation was not of the usual type found in such cases. *Subject Headings:* **1. Precipitation forecasting 2. Typhoon "June" (1954) 3. Hokkaido, Japan.**—*M.R.*

11.3–123 551.509.324.2:551.578.1:551.579.1(522)

Yamada, S. and Yahiro, T., **Quantitative precipitation forecasting by river basins in Kyushu.** *Journal of Meteorological Research*, Tokyo, 9(9):633–641, Sept. **1957.** 3 figs., 6 tables, 5 refs. In Japanese; English summary p. 633. **DWB, DLC**—The purpose of this paper is to discuss a method of quantitative precipitation forecasting by basins in Kyushu district. First the general features of precipitation in Kyushu district are examined, that is: monthly frequency of precipitable water, the relation of stability index (after A. K. SHOWALTER) to the total amount of precipitation in Kyushu district, the joint relationship of the stability index and the precipitable water with the amount of precipitation in Kyushu district, etc. Next, the characteristic features of precipitation amount by basins in Kyushu district are examined. Finally, a method of objective forecasting of precipitation by basins in Kyushu district is examined, and a work sheet is given. *Subject Headings:* **1. Precipitation forecasting 2. Precipitable water 3. Kyushu District, Japan.**—*Authors' abstract.*

11.3–124 551.509.324.2:551.577.21(521.1)

Yamashita, H. and Sumino, M., **Objective forecasting of rainfall amount at the basin of river Kitakami by cold front associated with upper high-latitude trough.** *Journal of Meteorological Research*, Tokyo, 10(5):369–375, May **1958.** 7 figs., 2 tables, 9 refs., 12 eqs. In Japanese; English summary p. 369–370. **DWB.** Also issued as: *Sendai, Japan. Central Meteorological Observatory, Journal of Meteorological Research of Tohoku District*, Vol. 12, Memoir No. 1, March **1959.** 7 p. 7 figs., 1 table, 9 refs.—The authors studied the objective forecasting method for rainfall amount in the River Kitakami basin from the standpoint of dam control and routine forecasting. The River Kitakami basin is divided into 16 regions. The daily rainfall amount falls into three classes: Class A: Maximum amount (of rainfall in small regions) over 25 mm. Dam is controlled. Class B: Maximum amount over 10 mm and less than 25 mm. Dam is controlled. Class C: Maximum amount less than 10 mm. Dam need not be controlled. Authors obtained five forecasting diagrams for the prediction of three classes of rainfall amount, and used predictors as follows: (i) Vorticity tendency $\partial\zeta/\partial t$: This is the local change of relative vorticity during past 24 hrs, and is shown $\bar{z}-z$ on 500 mb level, grid length used being 1000 km at 40°N, 138°E when a surface cold front passed over Tohoku District. (ii) Transported vapor (MxV): An air parcel is lifted 100 mb at 1000 mb level, 80 mb at 900 mb level, and 0 mb at 500 mb level, assuming a linear increase of lift with pressure. Owing to this process, the amount of liberated vapor m_1 and of vapor released from the convective instability m_2 are computed. The data are based on the upper air sounding at Sendai when the surface cold front is over the Japan Sea. $M=m_1+m_2+1$ and V is the sum of south components of wind at 850 mb and 700 mb level in meters per second. (iii) Showalter's stability index. (iv) Vertical instability index. (v) Effective vapor for rain $(2\sigma-\sigma^1)$. (vi) Tendency of saturation deficit. The final forecast is decided only when three or more of the independently predicted classes of rainfall amount by the five forecast diagrams coincide with one another. The verification of this method is shown in a table. *Subject Headings:* **1. Objective rainfall forecasting 2. Rainfall amount 3. Dam control 4. Upper level troughs 5. Kitakami River Basin, Japan.**—*Authors' abstract.*

FOG

11.3–125 551.509.325:551.575.1(716)

Davies, A. F., **An investigation of the applicability of Lee's method for radiation fog forecasting.** *Canada. Meteorological Branch, CIR*-3089; TEC-278, Aug. 19, **1958.** 8 p. 6 tables, ref. **DWB, DLC**—A method of radiation fog forecasting presented by LEE in 1955 was evaluated for sixty-six potential radiation fog situations at Greenwood, Nova Scotia, during the year 1951. The frequent occurrence of precipitation at this terminal violated a necessary condition at one step in the calculations and reduced the number of cases to which the method was applicable to twenty-one. It was shown, however, that the method could be modified so as to make it applicable whether or not precipitation had occurred. With these

modifications the method was applied to thirty-five radiation fog situations in the year 1955. The modifications produced the same accuracy as the original method, giving approximately 75% correct results as a "Fog" or "No-Fog" predictor and root-mean-square timing errors of approximately four hours. The method was extended to various ranges of visibility and to advection-radiation fog situations with similar results. *Subject Headings:* **1. Radiation fog forecasting 2. Forecasting techniques 3. Precipitation effects on fog forecasting 4. Greenwood, Nova Scotia.**—*Author's abstract.*

11.3–126 551.509.325 551.510.42

†**Meteorological Office discussion [on] Fog forecasting.** *Meteorological Magazine*, London, 87(1028):51–58, Feb. **1958.** 32 refs. **DWB**—Discussion held at Royal Society of Arts on 21 Oct. 1957, covered forecasting of formation, duration and clearance of water fog at airports and effect of smoke around cities or industrial areas and its daily variations during the week. A lively discussion and a good list of references is included. *Subject Headings:* **1. Fog forecasting 2. Smoke 3. Industrial atmospheric pollution. I. Saunders, W. E. II. Ogden, R. J.**—*M.R.*

HURRICANES AND STORMS

11.3–127 551.509.327:551.515.23(263,74/75)

Cook, Chaepyo, **On the prediction of three-day hurricane motion.** Chicago. Univ., Dept. of Meteorology, Contract N6ori-02036, Project NR 082-120, ONR, Project Arowa, NBA, Report on Research (unnumbered), July **1957.** 12 p. 22 figs., table, 4 refs., 6 eqs.—A quantitative method for the prediction of three-day hurricane motion from vertically integrated mean flow charts is developed using the 7 hurricanes of August and September 1955 and several of the storms of that period. Key areas in the U. S. that were affected by those hurricanes as they moved from the West Indies into the States are indicated. *Subject Headings:* **1. Hurricane forecasting 2. Hurricane tracks 3. Caribbean 4. Atlantic Coast States.**—*N.N.*

11.3–128 551.509.327:551.515.2(73)

†Gentry, Robert C. and Simpson, R. H. (*both, National Hurricane Research Project, U. S. W. B., West Palm Beach, Fla.*), **Hurricanes.** *Smithsonian Institution, Report*, 1956, pub. **1957.** p. 301–328. 11 figs., 25 refs. **DWB, DLC**—A review is made of problems involved in forecasting hurricanes and various associated phenomena, namely hurricane inception, movement, changes of intensity, rainfall, floods and height of storm surge. Both theoretical papers and practical forecast methods are discussed. Some statistical material on hurricanes that affected the United States in the past (the 1954 and 1955 hurricanes in particular) is included. *Subject Headings:* **1. Hurricane forecasting 2. Hurricane analysis 3. United States.**—*G.T.*

11.3–129 551.509.327:551.515.23

Kamiko, T. and Gotō, Y., **On a method of forecasting typhoon tracks.** *Journal of Meteorological Research*, Tokyo, 10(8):655–660, Aug. **1958.** 12 figs., 2 refs., 5 eqs. In Japanese; English summary p. 655. **Comments** by T. Asakura and **[Reply by]** Kamiko. Ibid., 11(1): 79–80, Jan. **1959.** In Japanese. **DLC, DWB**—The authors adopted H. RIEHL's method for 24-hr forecasting of typhoon track since 1953 and obtained very good results except in the single case of Typhoon "Bess" in the first 10-day period of September 1957. Next, they modified H. RIEHL's method, and obtained that $(\bar{Z}+G)$-field (after FJØRTOFT) is helpful for forecasting typhoon track, viz., it is found that typhoon moves along the isoline of $\bar{Z}+G$. *Subject Heading:* **1. Typhoon track forecasting.**—*Authors' abstract.*

11.3–130 551.509.327:551.515.3

§Magor, Bernard W. (*Severe Local Storms Forecast Center, Kansas City*), **Mesoanalysis: some operational analysis techniques utilized in tornado forecasting.** *American Meteorological Society, Bulletin*, 40(10):499–511, Oct. **1959.** 12 figs., 12 refs. **DWB, DLC**—The tornado forecast becomes a small-scale problem as the tornado-generating severe thunderstorm area approaches a particular locality. Consequently, much of this problem can be solved by the best possible analysis of surface synoptic weather data. Various tornado occurrences were investigated and found to be associated with meso-lows. These meso-lows were depicted

either by the intersection of two instability lines or by the intersection of a squall line with a northeastern boundary of rain-cooled air. An explanation is given for the formation of tornadoes along this intersection. *Subject Headings:* **1. Mesoanalysis 2. Tornado forecasting procedures 3. Synoptic conditions for tornadoes.**—*Author's abstract.*

11.3–131 551.509.327 551.515.23

Nature's deadly weapon, hurricanes: their force, formation and forecasting. Reprint of various sections of *The Petroleum Engineer*, Dallas, Aug. and Sept. **1957.** 13 p. 22 figs., photos. Includes 2 articles: Riehl, Herbert: **How hurricanes form.** Also his: **Hurricane motion and its forecasting. DWB** (M15.2 P497na)—In addition to a description of Hurricane "Audrey" (1957), the article contains two papers by H. Riehl. In the first paper, thermodynamic and dynamic aspects of hurricane formation, and possibilities of forecasting hurricane formation on the basis of sea temperature or the general circulation are discussed. The second paper takes up the factors determining hurricane tracks and methods of hurricane track prediction. *Subject Headings:* **1. Hurricane forecasting 2. Hurricane track forecasting 3. Hurricane "Audrey" (1957).**—*G.T.*

11.3–132 551.509.327:551.515.23

Rodewald, M., **Die Bahnen der tropischen Wirbelstörme.** [Paths of tropical cyclones.] *Der Seewart*, Hamburg, 19(2):52–64, April **1958.** 9 figs. **DWB**—Basic rules for determining hurricane motion are developed and illustrated by schematic diagrams and an example showing the structure and movement of Hurricane "Carrie" (1957) in relation to the general synoptic pattern. *Subject Headings:* **1. Hurricane track forecasting 2. Hurricane "Carrie" (1957).** —*G.T.*

11.3–133 551.509.327:551.515.23

Sanders, Frederick, **The application of pressure-averaged flow to the problem of hurricane displacement.** Massachusetts Institute of Technology. Dept. of Meteorology, Contract AF 19(604)-1305, Scientific Report No. 6, Feb. **1959.** 73 p. 22 figs., table, 6 refs., 20 eqs. **DWB** —The motion of hurricanes is considered in relation to the pattern of flow averaged with respect to pressure over the layer bounded by the 1000 mb and 100 mb surfaces. Application of the barotropic prediction model to such a flow, together with an appropriate graphical horizontal averaging of the pattern of flow, yields a basic "steering" current in accordance with which the hurricane may be expected to move. The motion of hurricanes "Carol" and "Hazel" of 1954, "Betsy" of 1956, and "Daisy" and "Ella" of 1958 is compared with corresponding patterns of the steering current. The root-mean-square magnitude of the vector error in specification of the concurrent storm motion is slightly larger than three knots. Twenty-four-hour displacement forecasts are made on the assumption that the steering current is steady. The root-mean-square position error in such forecasts is somewhat in excess of 100 n.m. Large individual errors occur when the hurricane itself is embedded within a mobile cyclonic circulation of larger scale but it does not appear that the evolution of the large-scale flow pattern is significantly influenced by the hurricane. Comparisons are made between the pressure-averaged flow and the flow at the 500 mb level. When the two are significantly different, the motion of the hurricane is more nearly in accord with the former, particularly in instances of northward-moving storms. Limited attempts are made to utilize a stream function based solely upon the observed winds. It is found that judicious application of the geostrophic approximation is useful even in lower latitudes. It is concluded that significantly greater accuracy in the short range prediction of hurricane displacement can be achieved only with a substantial increase in the amount of data available throughout the troposphere in the vicinity of the storm, and that this accuracy is strictly limited in any event by the precision with which the evolution of the large-scale flow pattern may be predicted. *Subject Headings:* **1. Hurricane displacement forecasts 2. Pressure-averaged flow 3. Hurricane steering.**—*Author's abstract.*

THUNDERSTORMS

11.3–134 551.509.326:551.578.71:551.551

Duvergé, Pierre, **Quelques méthodes récentes de prévision des orages.** [Some recent methods for forecasting thunderstorms.] *La Météorologie*, Paris, Ser. 4, No. 51:191–207,

July/Sept. 1958. 10 figs., 13 refs. French, English and Spanish summaries p. 191. **DWB**—The author successively examines various objective methods for forecasting storms. According to SHOWALTER'S "Stability Index" (merits and defects are pointed out) and GALWAY'S "Lifted Index" (theoretical bases are more satisfactory), he analyzes the methods recently developed by the Severe Local Storm Forecast Center. Daily synoptic analysis led the American forecasters to formulate all the conditions favorable for strong thunderstorm formation. The author reviews and comments on the synoptic, thermodynamic and dynamic consideration and examines the influence of the wind field and the structure of jet streams, the line of zero variation at 700 mb and the pressure jump line. Account of the procedures of S.E.L.S. enabling them to forecast the size of hailstones and the zones of very strong turbulence is given. *Subject Headings:* **1. Thunderstorm forecasting techniques 2. Hailstone size forecasting**—*A. V. and author's abstract.*

11.3–135 551.509.326:551.515.4 621.396.663(485)

Karlsson, K. E., **Åskpejling som stöd och verifikation av åskprognoser.** [Radio direction finding of thunderstorms as applied to support and verification of thunderstorm forecasts.] *Sweden. Meteorologiska och Hydrologiska Institut. Meteorologiska Byrån, Notiser och Preliminära Rapporter*, 2(2):**1959.** 4 p. fig. **DWB** (M(055) S974no)—An unexpected thunderstorm may be disastrous to projects using electronic discharge of dynamite. The subscribers to the 24-hr thunderstorm-risk forecasts made by the Aerological Division of the Swedish Meteorological and Hydrological Institute will have more reliable forecasts in the future. A. SIMILAS' method, which has been used since 1950 has been improved. Now the new radio direction finding instruments developed and constructed at the Institute for High Voltage Discharge, Uppsala, check and report any discharges within liability regions (as of July 19, 1958). Reports are made at 0800, 1200 and 1500 h. The nonrisk forecast 0730 h, July 24, was corrected by means of the new method at 1100 when "fair to great risk" was forecast. The thunderstorm struck at 1255 h. It is suggested that the R.D.F. instrument ought to be located and operated by a weather station. *Subject Headings:* **1. Radio direction finders 2. Thunderstorm forecasting 3. Sweden.**—*W.N.*

11.3–136 551.509.326:551.515.4(540)

Pant, P. S. (*Dept. of Physics and Met., Indian Inst. of Technology, Kharagpur*), **Summer thunderstorms at Calcutta.** *Indian Journal of Meteorology and Geophysics*, Delhi, 9(2):200–201, April **1958.** fig. **DWB, DLC**—Two important predictors of summer thunderstorms at Calcutta are the Stability Index and the relative humidities at standard pressure levels between 850 and 500 mb. These are examined objectively to determine better methods of forecasting. *Subject Headings:* **1. Summer thunderstorms 2. Thunderstorm forecasting 3. Calcutta, India.**—*N.N.*

11.3–137 551.509.326:551.515.4(54)

Rao, Y. P. and Hariharan, P. S. (*Met. Office, Bombay*), **Unusual thunderstorm activity in peninsular India possibly due to upper divergence.** *Indian Journal of Meteorology and Geophysics*, Delhi, 8(4):452–455, Oct. **1957.** 3 figs., 4 refs. **DWB, DLC**—Upper winds at Madras and Allahabad are shown on time-altitude cross-sections for June 13 and 14, 1956—a period of widespread thunderstorm activity over Peninsular India south of lat. 20°N. Northerly winds to 6 km did not indicate advent of such activity. Upper flow charts at 5.4 km give some clue to possible cause: upper divergence combined with daytime heating and subsequent self-sustaining or even expansion of activity through the night; an upper trough alone could not explain the weather. *Subject Headings:* **1. Thunderstorm forecasting 2. Upper level divergence effects 3. Madras, India.**—*M.R.*

11.3–138 551.509.326

Telfer, Ray T. (*USAF, Carswell Air Force Base, Texas*), **A practical way to make airmass thunderstorm forecasting easier and more reliable.** *American Meteorological Society, Bulletin*, 39(1):1–7, Jan. **1958.** 7 figs., 3 refs. **DWB, DLC**—This study introduces a plastic device for mechanically progging soundings rapidly. It also shows how this device can be used with

the Bailey local thunderstorm forecasting graph to make local thunderstorm forecasting easy and more reliable. *Subject Heading:* **1. Thunderstorm forecasting.**—*Author's abstract.*

LONG RANGE FORECASTING

11.3–139 551.509.331:551.576.2:551.577

Brádka, Jan, **Závislost srážek a oblacnosti na advekci a zakřivení isohyps.** [Dependence of precipitation and cloudiness upon advection and the curvature of isohypses.] *Meteorologické Zprávy*, Prague, 10(6):145–149, **1957.** fig., 5 tables, 5 refs., eqs. Czech, Russian and German summaries p. 145. **DWB**—On the basis of aerological data for Prague (1954–1955), the relation between precipitation frequency and intensity, and advection, curvature of the 500 mb isohypses and 500 mb wind direction during each season is statistically analyzed. Three precipitation types are identified, those associated with warm fronts, cold fronts and upper air cyclones, respectively. Precipitation formation in upper air cyclones is discussed in detail. *Subject Headings:* **1. Precipitation formation 2. Synoptic conditions for precipitation.**—*Author's abstract.*

11.3–140 551.509.331:551.577(439.1)

Drogaĭtsev, D. A., **Dolgosrochnyĭ prognoz osadkov po Vengrii.** [Long range precipitation forecasting for Hungary.] *Időjárás*, Budapest, 62(1):11–19, Jan./Feb. **1958.** 3 figs., table, 7 refs., eq. German summary p. 11. Hungarian summary p. 19. Also: Berkes, Zoltán, **A Drogajcev-féle csapadékelőrejelzés beválása.** [Drogaĭtsev's precipitation forecast correct.] *Ibid.*, 62(4):225, July/Aug. **1958.** table. **DLC**—A method of long range precipitation forecasting is developed for the first half of the vegetation period, April–June. The method is based on a correlation between variations in meridional heat transfer during October–December (D, expressed in dynamic decameters) and precipitation amount (R, in mm) during the following April–June. The correlation coefficient between D and R is found to be 0.81 and the regression equation is $R = 1.008 \times D - 37.7$. Berkes examines the actual precipitation in Hungary in April–June 1958 and finds that Drogaĭtsev's forecast error is only 2.5%. The annual standard deviation is ten times that figure. Monthly and regional deviations and their probabilities are also discussed. *Subject Headings:* **1. Long range precipitation forecasting 2. Meridional heat flux-precipitation correlations 3. Hungary.**—*Transl. of author's abstract and G.T.*

11.3–141 551.509.331:551.526(573)

Glagoleva, M. G.; Sauskan, E. M. and Tiutnev, Ia. A., **Metod prognoza temperatury vody u iugo-zapadnogo poberezh'ia o. Sakhalin.** [Method of forecasting water temperature on the southwest coast of Sakhalin Island.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 57:87–131, **1957.** 15 figs., 14 tables, 9 refs. **DLC**—One of the fundamental indicators of the oceanographic and biological factors causing changes in the number of spawning sardines and the time of their spawning in the Sea of Japan along the southwest coast of Sakhalin is the temperature of the water. In this study the authors analyze the temperature regime of the waters of the southwest coast of Sakhalin and the factors determining the variation of temperature and develop a procedure for forecasting 5–15 days in advance. The contents of this study include the following: analysis of the frequency of fishing season over the period 1931–53, the spawning habits of the sardine and the associated mean monthly water temperatures at Kholmsk, Antonovo and Ilinsk, mean monthly water temperatures in 0–10 m layer for Feb., March and April for each year from 1928 to 1953, water temperatures during the second decade of April when the fishing season usually begins, analysis of the monthly regime of the heat balance components (for March and April for the period 1929–51) of the sea surface in the Gulf of Tatary and the Sea of Japan and variations of vertical temperature distribution in the sea, possibility of making short range forecasts of water temperature at various points (Kholmsk, Antonovo, etc.) on the basis of synoptic periods or moving 5-day means with the aid of empirical equations as a function of air temperature and of air temperature and pressure difference between two specified points (Tokyo-Nikolaevsk-on the Amur, e.g.), computation of the heat balance of the surface layer of the open part of the Sea of Japan, calculation of

temperature variations of the waters of the Sea of Japan and of the southwest coast of Sakhalin and long range forecasting of water temperatures at the start of the fishing season with the aid of empirical equations and the reliability of the forecasts. *Subject Headings:* **1. Forecasting techniques 2. Water temperature forecasting 3. Water temperature variations 4. Long range water temperature forecasting 5. Sakhalin Island.**—*I.L.D.*

11.3–142 551.509.331:551.509.314(52)

Yamaguchi, K. and Urakawa, T., **On a method of thirty-day forecasting by period analysis.** *Journal of Meteorological Research*, Tokyo, 9(11):823–830, Nov. **1957.** 6 figs., 3 tables, eqs. In Japanese; English summary p. 823. **DWB-DLC**—A new method of thirty-day forecasting of daily mean pressure by use of daily mean pressure during the past one month was examined. That is, the past pressure variation can be expressed by the sum of sine or cosine function with integral period in unit of day, by the least square method. And, in this examination the integral periods from 3 to 15 days were used without using the particular periods. Some examples are given. The forecasting accuracy in winter season is better than the other seasons. *Subject Headings:* **1. Long range forecasting techniques 2. Japan.**—*Authors' abstract.*

11.3–143 551.509.332:551.524.32(52)

Ando, M., **On the unusually cold weather during June and July 1954.** *Journal of Meteorological Research*, Tokyo, 8(5):254–262, June **1956.** 11 figs., 7 refs. In Japanese; English summary p. 254. **DWB, DLC**—Japan experienced unusually cold weather persisting for two months from the beginning of June to almost the end of July 1954. A synoptic analysis reveals that the abnormal coldness over Japan and its neighborhood was related to the circulation which was of hemispheric scale. It is suggested that the abnormal weather could have been predicted from the extensive and strong positive departure of the surface pressure over the high latitudes around the Arctic area in May. It is also shown from the computation of the quantity of air mass over each latitudinal band of the Northern Hemisphere that the strong positive departure of surface pressure over high latitudes was brought about by enormous transportation of air mass northwards from lower latitudes during March and May 1954. *Subject Headings:* **1. Cold springs 2. Synoptic conditions for cold springs 3. Japan.**—*From author's abstract.*

11.3–144 551.509.332:551.577.34(52)

Arakawa, H.; Yoshimoto, H. and Suzuki, E., **Could the recent trend of gradual increase of precipitation in Japan continue?** *Journal of Meteorological Research*, Tokyo, 10(3):159–163, March **1958.** 5 figs., 3 tables, 4 refs. In Japanese; English summary p. 159. **DWB, DLC**—The recent gradual increase of precipitation in Japan is really of great practical value for hydroelectric operation. Could this high level of precipitation in Japan continue for a couple of years? From the purely statistical point of view, this problem has been studied and it was temporarily concluded that this trend may be checked although the discussion is far from conclusive. *Subject Headings:* **1. Long-range precipitation forecasting 2. Precipitation trends 3. Japan.**—*Authors' abstract.*

11.3–145 551.509.332

§Kletter, L. (*Vienna*), **Eine Methode zur Verbesserung der mittelfristigen Wettervorhersage.** [A method for improvement of extended weather forecasts.] *Meteorologische Rundschau*, Berlin, 11(4):109–112, July/Aug. **1958.** 7 figs., 6 refs., 10 eqs. **DWB, DLC**—In this method of extended weather forecasting 850 mb charts averaged for 5 days are used. In order to determine the means, 150 Northern Hemisphere points, whose values h_{na} or h_{np} (height of the 850 mb forecast surface above a point of the forecast area on the n-day a.m. or p.m.) were recorded daily at 0 and 12 h G.M.T., were selected. The five day mean of the height of the absolute topography of the 850 mb surface above a point of the forecast area $H_{-4p}{}^{0p}$ is:

$$H_{-4p}{}^{0p} = \tfrac{1}{10}(h_{-4a}+h_{-4p}+h_{-3a}+h_{-3p}+h_{-2a}+h_{-2p}+h_{-1a}+h_{-1p}+h_{-0a}+h_{-0p}).$$

By determining $H_{0a}{}^{4p}$ a forecast mean chart for four days is obtained:

$$H_{0a}{}^{4p} = \tfrac{1}{10}(h_{0a}+h_{0p}+h_{1a}+h_{1p}+h_{2a}+h_{2p}+h_{3a}+h_{3p}+h_{4a}+h_{4p}).$$

The principal influences bringing about the transition of

$$H_{ip}^{0p} \rightarrow H_{0a}^{4p}$$

are the following: the "weather history," the present weather, the surroundings, the normal condition and new developments. In practice an intermediate stage H_{-2p}^{3a} between H_{-4p}^{0a} and H_{0a}^{4p} is determined and finally another extended forecast is computed. This problem is solved approximately by a sequence of four values (H_{-4p}^{0p}, H_{-2p}^{3a}, H_{0a}^{4p}, T) which yield the development stages of the large scale weather situation. H_{-4p}^{0a} is determined by the procedure devised by J. NAMIAS. The determination of the individual influencing factors is illustrated and the results of the application of this procedure in individual cases are presented in the form of synoptic maps. A good agreement is found between forecast and actual weather. *Subject Headings:* **1. Forecast improvement 2. Extended forecasting.**—*I.L.D.*

11.3–146 551.509.332:551.509.312

Kubota, S. (*Met. Res. Inst., Tokyo*), **Simplified method for the prediction of the surface pressure change.** *Papers in Meteorology and Geophysics*, Tokyo, 9(1):1–14, May **1958.** 13 figs. (1 fold.), 2 tables, 2 refs., 15 eqs. Japanese summary p. 13–14. **DWB**—A method to solve the ω-equation by use of the inverse matrices was proposed in my previous study. Using the observed data, the stability and representative scale appearing in the matrices could be determined. In this paper, the surface pressure change was calculated by the simplified baroclinic model, in which the value of the vertical velocity w was calculated by the method stated in the previous paper. It was found from the results thus calculated, that the development of the low pressure area can be easily predicted, provided that the cause of that development is attributable to the upper disturbances such as can be seen in the "Japan Sea cyclone." Further, the magnitudes of the effects of convergence and the vertical transport of the absolute vorticity by the vertical velocity and others were also examined. *Subject Headings:* **1. Pressure change forecasting 2. Vertical wind velocities 3. Baroclinic models.**—*Author's abstract.*

11.3–147 551.509.332:551.547.3

Lecce, B. and Del Trono, F. (*both, Met. Service, Minist. of Aeronautical Defense, Italy*), **Variazioni periodiche del campobarico medio a 500 mb su scala emisferica, e loro utilizzazione nella previsione a lunga scadenza.** [Periodic variations of the mean 500 mb baric field on an hemispheric scale and their use in long range forecasting.] *Geofisica e Meteorologia*, Genoa, 6(1/2):1–6, **1958.** 5 figs., 2 tables, 4 refs. **DWB**—The nature of pressure singularities is discussed briefly and the characteristics of the mean annual pressure variations at the ground and at 500 mb obtained by eliminating short period disturbances are considered. The ground pressure wave reflects regional peculiarities while the 500 mb wave reflects properties common to all regions and is sinusoidal with periods of about a year and with well defined minima and maxima characteristics of summer and winter, respectively. The distribution of minima or maxima of the entire Northern Hemisphere can be regarded as an index of the mean prevailing circulation for the winter and summer and constitutes the basic field upon which the singularity develops. Such a field undergoes regular interannual variations which can be followed across extensive centers of pressure nuclei (generally two positive and two negative for the Northern Hemisphere) moving from west to east with a velocity of about 60–70° longitude per year. A direct proportionality exists between the variations of the pressure field along an axis of well defined configuration and the variations of the cosines of latitude. The evolution of the pressure field serves to forecast types of prevailing weather in various regions for different seasons. It was found also that the annual total rainfall amount for Rome had for eight consecutive years the same pattern as the minimum of the annual pressure wave. *Subject Headings:* **1. Annual pressure variations 2. Long range forecasting 3. Pressure singularities.** —*Authors' abstract and I.L.D.*

11.3–148 551.509.332(234.3)

Reiter, Elmar R., **Die Verwendung von Kontinuitätsdiagrammen in der nordalpinen Wetterprognose.** [Use of continuity diagrams in north Alpine weather prediction.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, Vienna, 10(2/3):161–177, **1958.** 6 figs., 15 refs., 6 eqs. French, German and English summaries p. 161. **DWB, DLC**—With

the aid of HOVMÖLLER's trough and ridge diagram the superposition of wave motions and group velocity is studied and the results are applied to four to five days extended range forecasts for the northern Alpine region. The influence of föhn and upslope is taken into account by the geostrophic meridional component of the 500 mb circulation at 45°N. lat. A continuity diagram (Meridional Circulation diagram = MZD) has been devised which allows for estimation of this influence for prognostic purposes. The application of MZD and HOVMÖLLER's diagram are discussed by using January and February as an example. *Subject Headings:* **1. Extended forecasting 2. Meridional circulation diagrams 3. Northern Alps.**—*Author's abstract.*

11.3–149 551.509.334:551.513 551.557:551.510.533

Barbé, Georges, **Sur l'établissement du régime d'été de la circulation stratosphérique entre 20 et 30 km au voisinage de la latitude 45°N. Caractère anormalement précoce de l'année 1959.** [The onset of the summer regime in stratospheric circulation between 20 and 30 km, in the vicinity of latitude 45°N. Abnormally early character of the year 1959.] *Académie des Sciences, Paris, Comptes Rendus*, 248(22):3196–3198, June 1, **1959.** fig., table, 6 refs. **DWB, DLC**—The summer reversal (from West to East) of the stratospheric circulation between 20 and 30 km was, in 1959, almost two months in advance of the assumed normal date of this change—the beginning of May. It seems possible to link up the abnormal character of the circulation near the ground and the early spring of 1959. Accordingly, the author admits that the high stratospheric circulation within the 20–30 km layer has a planetary character. This circulation is directly influenced by the various radiations issued from the sun and interstellar space. It seems sound to infer that this circulation exerts an action on the circulation within the lower atmospheric layers—the tropospheric circulation and more generally on the climatic peculiarities of the seasons of a given year. *Subject Headings:* **1. Stratospheric circulation 2. Solar radiation-stratospheric circulation relationships 3. Long range forecasting.** —*A.V.*

11.3–150 551.509.334

Blagoev, Khr., **Kak se sŭstavia mesechnata prognoza.** [How monthly forecasts are prepared.] *Khidrologiia i Meteorologiia*, Sofia, No. 4:33–45, **1956.** 7 figs., 4 refs. Russian and English summaries p. 44–45. **DLC**—The Multanovskiĭ school's method of long range forecasting by synoptic analogy is described. Sample schematic charts are included. *Subject Headings:* **1. Multanovskiĭ's method 2. Long range forecasting techniques.**—*G.T.*

11.3–151 551.509.334(52)

Fukuda, K., **On the relation between the Arctic front in November and the following summer climate of North Japan.** *Journal of Meteorological Research*, Tokyo, 10(4):247–252, April **1958.** 6 figs., table, 2 refs. In Japanese; English summary p. 247. **[Comments]** by S. Takahashi and [Reply by] Fukuda. *Ibid.*, 10(10):902–904, Oct. **1958.** 2 figs., 3 tables. In Japanese. **DWB**—When stationary long waves in westerlies predominate in November, the pressure is abnormally high at about 90°E and low at about 160°E. These conditions are likely to persist till the following summer in some pattern or other. But in summer the pressure is abnormally high at about 160°E during the prevalence of long waves and then a cool summer appears in North Japan. Following the above principle, it is found from the distribution chart of deviation of monthly mean pressure in the Northern Hemisphere in November that, either when the center of plus area is situated at about 60°N, 90°E or when the minus area center is at about 55°N, 160°E, the next summer is followed by abnormally cool weather in north Japan, while there prevails also a cool summer when the center of minus area situates at 60°N, 90°E in November. In this case the Arctic front in the neighborhood of northern Europe deviates remarkably from normal to the east and developed cyclones appear frequently at about 90°E where normally cyclones develop rarely. *Subject Headings:* **1. Waves in the westerlies 2. Pressure pattern—cool summer relationships 3. Arctic fronts 4. Japan.**—*Author's abstract.*

11.3–152 551.509.334

Isaev, E. A., **K voprosu o preemstvennosti sinopticheskikh protsessov.** [Problem of the sequence of synoptic processes.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy,*

No. 65(127):19–26, **1956.** 6 figs., 6 tables, 2 refs. **DLC**—The rhythmicity and sequence of transpolar synoptic processes in February is investigated by analyzing the transpolar incursions of an anticyclone from the Kara Sea or the Taimyr Peninsula southwest into European U.S.S.R. This synoptic process is termed Type 4a of the winter circulation. It is one of the last completed stages in the sequence of development of winter processes and is characterized by the extension of the Atlantic westerly flow over the European continent, when under the influence of a cold anticyclone over European Russia, it assumes a southwesterly direction. The northeasterly flow at the periphery of the anticyclone over western Siberia and the southwesterly flow over the Scandinavian meridian constitute the main weather forming elements. Their interaction is maintained as long as it is not interrupted by the flow from the Taimyr Peninsula. In March this process is followed by the formation of an anticyclone over western Siberia and European U.S.S.R. with a cyclonic field over the Yenisei and Western Europe. In April there occurs a meridional process with an incursion of an anticyclone from the Barents Sea to the south and southeast and the formation of a quasistationary field over the central European U.S.S.R. Three months after the first initial transpolar incursion (in May), anticyclogenesis repeats itself over the U.S.S.R. with the difference that the incursion from the Kara Sea is displaced at first to the north of European U.S.S.R. and then assumes a southeast direction. In June the incursion of the anticyclone proceeds from Greenland to the southeast. The process assumes a summer character, which expresses itself in the liquidation of the Siberian anticyclone and the formation of a cyclonic field in Siberia. The fifth month after the transpolar incursion is characterized by a summer circulation type. Statistical data on the frequency of Type 4 of the winter circulation in the sequence of the first subtype of the Type 4 circulation, frequency of Type 4 of the summer circulation, etc. are presented. *Subject Headings:* **1. Synoptic patterns 2. Synoptic processes over Eurasia 3. U.S.S.R. 4. Eurasia.** —*I.L.D.*

11.3–153 551.509.334:551.543:551.513.1

Jílek, Josef, **Význačný pochod ultrapolární.** [Characteristic ultrapolar process.] Meteorologické Zprávy, Prague, 8(4):102–104, Aug. **1955.** 2 figs. Russian and French summaries p. 102. **DWB.** Review by Z. Berkes in *Időjárás*, 60(3):183–184, May/June **1956.** 2 figs.—It is shown that an ultrapolar process is the relatively rare case (occurring 7 to 8 times a year in Czechoslovakia) in which a circumpolar wind is divided into two parts. MILDNER suggested that preceding and subsequent pressure development shows a symmetric pattern in reference to the ultrapolar process. This was not confirmed. *Subject Headings:* **1. Symmetry points 2. Zonal flow stability.**—*Transl. of author's abstract.*

11.3–154 551.509.334:551.582(439.1)

Kálmán, Éva (Cseh), **Tipy pogody po klassifikatsii A. F. Diubiuka v pogode Budapeshta v periode 1952–54 g.** [Diubiuk's weather types in the weather of Budapest in 1952–54.] *Időjárás*, Budapest, 63(1):28–36, Jan./Feb. **1959.** 5 tables, 2 refs. English summary p. 28; Hungarian summary p. 34–36. **DLC**—The existence of DIUBIUK's weather types in the weather of Budapest are discussed. The author determines the hourly and seasonal frequency of DIUBIUK's types, and discusses the monthly distribution of the types and their distribution between the hours of night and of daytime. The last part of the paper deals with the relative frequency of the frontal hours and of those without front. *Subject Headings:* **1. Weather type frequencies 2. Climate of Budapest 3. Budapest, Hungary.**—*Author's summary.*

11.3–155 551.509.334

Maede, Hans, **Mittelfristige Vorhersageregeln auf Grund von Beziehungen zwischen Charakteristiken der nordhemisphärischen 500-mb-Fläche.** [Extended forecasting rules on the basis of relations between 500 mb Northern Hemisphere characteristics.] *Zeitschrift für Meteorologie*, Berlin, 11(10/11):311–321, Oct./Nov. **1957.** 2 figs., 5 tables, 7 refs. **DWB, DLC** —By means of a synoptic statistical method which involves the use of specific characteristics of the 500 mb surface over different regions of the Northern Hemisphere and weather over Central Europe up to the seventh successive day, an attempt is made to improve the quality of extended forecasts. These relationships are based upon multiple correlation tables constructed

in the Institute of Large Scale Weather Research at Potsdam. The characteristics of the 500 mb surface for the Western Atlantic, Eastern Atlantic, Central Europe, Eastern Europe and Northern Europe include the following: smoothed three day means of the deviations of the daily values of the zonal component of the 500 mb surface from the normal monthly means; smoothed three day means of the deviations of the meridional components at 500 mb from the normal monthly means; smoothed three day means of the deviations of the height of the 500 mb surface from the normal monthly means at the center of the corresponding area; the computed interdiurnal variations and the deviations of the zonal components in the entire region between the east American coast and the Urals from the monthly means. The weather over Central Europe is characterized by the Kissingen large scale weather situation. The application of the method to the North Atlantic is illustrated with the aid of tables showing the relative frequencies (in %) of large scale weather types for different circulation values of the East Atlantic and Eastern and Northern Europe. Rules for making probability forecasts on the basis of various combinations of characteristics are described. *Subject Headings:* **1. Extended forecasting 2. Large scale weather processes.**—*I.L.D.*

11.3–156 551.509.334:551.515.7(5–012)

Saito, T., **Relation between blocking and variation of Grosswetter over the Far East.** *Journal of Meteorological Research*, Tokyo, 10(3):212–216, March **1958.** 4 figs., 3 refs. In Japanese; English summary p. 212. **DWB, DLC**—The author examined the relation between blocking and variation of Grosswetter over the Far East synoptically. Principal results are as follows: 1) Continuity chart in high latitudes is very helpful for forecasting the blocking; 2) A characteristic weather type is accompanied by the marked retrograde wave in high latitudes during two months; 3) Blocking action for weather is most effective in Hokuriku district. *Subject Headings:* **1. Blocking effects on large scale weather processes 2. Far East.**—*Author's abstract.*

11.3–157 551.509.334:551.513.2:551.589.1(52)

Suda, Ken (*Japan Met. Agency, Tokyo*), **The mean pressure field characteristic to persistent cold waves in the Far East.** *Meteorological Society of Japan, Tokyo, 75th Anniversary Vol. of the Journal*, pub. Nov. **1957.** p. 192–198. 5 figs., 10 refs. **DWB, DLC**—The pressure patterns characteristic to extreme warmth and coldness in north Japan are compared with each other on various composite maps and 500 mb correlation field. It is found that the eastward shift of the Far Eastern permanent trough due to the combined effect of the geographical condition of the Far East and the decrease of zonal index is responsible for the large scale cold waves in north Japan. *Subject Headings:* **1. Cold waves 2. Pressure patterns 3. Air mass distribution 4. Japan.**—*Author's abstract.*

11.3–158 551.509.334:551.577.32(52)

Tomioka, S., **On a case study of ending time of Bai-u season.** *Journal of Meteorological Research*, Tokyo, 10(7):581–586, July **1958.** 13 figs., 7 refs., eq. In Japanese; English summary p. 581. **DLC**—The author examined a synoptic method of forecasting the end of Bai-u season based on the data of 1957, and obtained the following results: (1) So long as a stationary long wave trough exists west of 150°W, Bai-u season is not over. (2) Okhotsk High is not a cutoff high, but a northern part of developed Pacific High, at 700 mb surface. *Subject Headings:* **1. Bai-u 2. Synoptic forecasting 3. Japan.**—*Author's abstract.*

11.3–159 551.509.334

Yang, Chien-chu (*Inst. of Geophys. & Met., Academia Sinica*); Shih, Chiu-en and Ai, Tzuhsing (*both, Central Inst. of Met. Res. Centr. Weather Bureau*), **A method of seasonal long-range weather forecasting.** *Acta Meteorologica Sinica*, Peking, 30(1):53–63, Feb. **1959.** 11 figs., 8 tables. In Chinese; English summary p. 63. **DLC**—In this paper a method of seasonal long range weather forecasting is suggested. It is based upon the classification of natural synoptic periods, the rhythm of different types of natural periods and the correlations between periods. *Subject Headings:* **1. Long range forecasting techniques 2. Seasonal forecasting from periodicities.**—*Author's summary.*

11.3–160 551.509.336

Abbot, Charles G., **Detailed procedure used in Abbot's method of long-range weather forecasting.** *Solar Energy: the Journal of Solar Energy Science and Engineering*, Phoenix, 2(1):26–35, Jan. **1958.** 4 figs., 9 tables, 4 refs. **DWB**—As a result of 30 yrs of daily observations of the solar constant, the author discovered a numerous family of regular periodic variations of solar radiation, all integrally related to the master period of 273 months. Exactly the same family of variations was found in long-interval precipitation and temperature records, hidden to cursory search by phase changes due to various atmospheric influences. In solar variation the periods have ranges of only 0.05 to 0.21% of the solar constant, whereas in precipitation they range from 5 to 25% of normal, and in temperature up to 5°F. This paper describes in detail a method of forecasting precipitation and temperature which the author has evolved from this discovery. His method can be used for forecasts up to fifty years in advance, but yields only general features, such as monthly or seasonal effects, not weekly or daily changes. With the aid of C. WEXLER of Arizona State College, a forecast was made for Natural Bridge, Ariz., from 1950 to 1967. The results and a comparison with the event to 1957 are given in a graph. *Subject Headings:* **1. Long range forecasting 2. Long period precipitation records 3. Long period temperature records 4. Precipitation cycles 5. Temperature cycles 6. Abbot's forecasting method.**—*Author's abstract.*

11.3–161 551.509.336

Abbot, C. G., **Long-range weather forecasting.** *Smithsonian Miscellaneous Collections*, Wash., D. C., 138(3), **1959.** 19 p. 11 figs., 3 tables. **DWB, DLC**—The author divides long range weather forecasting into three types, namely: weather as regards season, sunspot activity and secular time; and further discusses all the integral periods of weather in relation to the 273 months accepted as a master period associated with HALE'S solar magnetic period. Weather trends in forecasts and hindcasts are discussed. The increasing importance of long range weather forecasts in industry is illustrated. *Subject Heading:* **1. Long range forecasting.**—*N.N.*

SINGLE STATION FORECASTING—LOCAL FORECAST STUDIES

11.3–162 551.509.34(794)

Dalton, Q. S. and Lakin, L. E., **Meteorological concepts for a practicing meteorologist at Naval Ordnance Test Station.** *U. S. Naval Ordnance Test Station, Inyokern, TM* No. 284, July 1, **1953.** 9 p. 9 refs. **DWB?**—A collection of numerous local forecast rules based on experience and to some extent on climatological and aerological records used in connection with synoptic weather charts for the Pacific Coast Area. The rules are to be used for forecasting specific weather conditions which might affect NOTS operations (winds, turbulence, temperature, etc.) and for periods from a few hours to a week in advance. More stringent statistical tests of the rules are being made so as to develop objective tools as well as to evaluate these guiding principles. *Subject Headings:* **1. Local forecast rules 2. Inyokern, Calif.**—*M.R.*

11.3–163 551.509.34:016

†U. S. Weather Bureau, **Selected bibliography on local forecast development.** Sept. **1959.** 13 p. (mimeo.). **DWB** (M(016) U587sL)—This unannotated bibliography containing 135 references to English language objective forecasting studies is prepared to aid in planning and conducting studies in local forecasting, especially where the approach is basically empirical and statistical. Several references are included in a special group descriptive of different methods of approach. Some of these present statistical methods are too lengthy for hand computation and are only feasible if the investigator has access to a high speed computer. Nevertheless, the techniques have not been adequately tried on localized spot forecasting problems. References under the subjects: Temperature, Precipitation, Thunderstorms, Wind, and Ceiling and Visibility are selected to suggest the variety of predictors which have been studied as well as the different methods of processing statistical data and indicating results. The final sections include papers on different verification and forecast testing procedures, recommended reading on probability forecasting, and a list of a few of the statistical textbooks and papers which are

particularly useful in this field. *Subject Headings:* **1. Local forecast study bibliographies 2. Objective forecasting bibliographies.**—*I.S.*

11.3–164 551.509.34:551.515.2(914)

Manalo, Eugenio B. (*Chief, Climatological Division, Philippine Weather Bureau*), **An application of single station forecasting in the Philippines.** (In: Angola. Serviço Meteorológico, **Miscelanea geofisica.** Luanda, **1956.** p. 122–145. 10 figs., 6 tables, 2 refs., 5 plates.) **DWB** (M(08) A592mi)—This paper contains an application of single station forecasting in the Philippines. The writer gives a concise discussion of the different air streams and the different weather patterns that affect the Archipelago, in order to present an idea to the reader about Philippine weather. The characteristics of each air stream and the season of the year it is expected were likewise included. The methods of detecting the existence or the arrival of the different weather patterns based upon the data of a single station were presented. Concentration is made however on typhoons because of their destructiveness. Forecasting of this weather pattern using single station data is discussed in detail. This paper includes also the visual precursory signs, instrument behavior and, finally, the tracking and locating the vortex of typhoons. *Subject Headings:* **1. Single station forecasting 2. Typhoon forecasting 3. Philippines.**—*Author's abstract.*

11.3–165 551.509.34:629.13

Thompson, C. E., Thompson, H. A., Currie D. B. et al. (*all, Edmonton Dist. Aviation Forecasting Office*), **Notes on weather characteristics of Claresholm Airport, Claresholm, Alberta.** *Canada. Meteorological Div., Cir.* 2047, Tec. 104, Dec. 14, **1951.** Local Forecast Study No. 12. 8 p. fig., table. **DWB**—Location: 50°N, 113°38′W. Description of terrain, wind conditions (especially Chinook winds), radiation fog and low stratus, thunderstorms and dust storms. Data of wind observations for 1943 are added. *Subject Headings:* **1. Local forecast studies, Claresholm, Alberta 2. Aviation climatology 3. Claresholm, Alberta. I. Smith, D. H.**—*A.A.*

11.3–166 551.509.34(729.9)

§*U. S. Air Force. 9th Air Weather Group, **Local forecast study, Kindley Air Force Base, Bermuda.** Rev. Sept. 1, **1957.** 15 p. 13 figs., 12 tables, 10 refs. Photostat of typescript. **DWB** (M09.34 U582Lo)—A standard local forecast study for an Air Force base in Bermuda (St. David's Island) at 32°19′N, 64°45′W. Geography, influence of Gulf Stream, data, large scale synoptic patterns (summer and winter), easterly waves, typical summer, fall, winter and spring situations, analysis techniques, forecasting, long waves, bands of strong winds in westerlies, anticyclone centers, hurricanes and empirical methods are considered. Detailed climatological (ceiling, visibility, wind and flying weather) data for Kindley AFB (1941–1952) are included. Sea surface temperature charts, adiabatic diagrams, cross sections and typical synoptic charts also included. *Subject Headings:* **1. Local forecast studies, Bermuda 2. Climate of Bermuda 3. Kindley AFB, Bermuda.**—*M.R.*

11.3–167 551.509.34:629.13(758)

§*U. S. Air Weather Service, **Forecasting study for Turner Air Force Base.** *U. S. Air Weather Service, Technical Report,* No. 105-95, April **1953.** 55 p. 4 maps (fold.), 13 figs., numerous tables. **DWB** (M(055) M58a)—A thorough study of local climatology in the vicinity of Albany, Ga., to serve as an aid to forecasters at Turner Air Force Base. Objective procedures are emphasized and the major part of the work is devoted to fog conditions at different seasons and with different synoptic or air flow patterns. Synoptic and statistical analyses are given for each of the six phenomena considered important: 1) Pre-warm front weather; 2) Advection fog, 3). Post cold front, 4) Radiation fog, 5) Mixing radiation fog and 6) Tropical storms. Hourly surface data for 4 years (1943–1946 and 1948), and all upper charts and data available, were used. Catalogs of data used are appended. *Subject Headings:* **1. Local forecast studies, Albany, Ga. 2. Objective forecasting 3. Airport climatic data 4. Turner Air Base, Albany, Ga.**—*M.R.*

11.3–168 551.509.34:629.13(495)

U. S. Air Weather Service, **Local forecast study, Athenai Central Airport, Athens, Greece, [Study] No. 1.** April 1, **1953.** 32 p. figs. Photostat of typescript. **DWB** (M09.34 U58La)—Prepared as a guide to personnel making operational forecasts for Athenai Airport this study contains: (1) a description of topography with maps and aerial photographs; (2) an analysis of typical circulation patterns and associated weather characteristics, illustrated with charts; (3) suggested objective techniques for forecasting operationally significant weather changes; (4) a paragraph on severe weather and (5) a climatological summary with wind roses and temperature and precipitation curves. *Subject Headings:* **1. Local forecast studies, Athens 2. Airport forecasts 3. Athens, Greece.**—*G.T.*

LOCAL OR APPLIED FORECASTING OF SPECIFIC ELEMENTS

STRONG WINDS

11.3–169 551.509.52:525.63

Collins, George F. (*E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.*), **Du Pont tide and storm warning service.** *Weatherwise*, Boston, 10(5):164–167, Oct. **1957.** 3 photos. **DWB**—Personnel facilities, communications, functions of the office, routine operations, prediction of Delaware River tides, research and special study and economic justification for the service provided by meteorologists for Du Pont are described and illustrated. *Subject Headings:* **1. Tide warning services 2. Storm warning services 3. E. I. du Pont de Nemours & Co., Inc.**—*M.R.*

11.3–170 551.509.52:551.553.8

Sik, A. E. (*Radio Marine Section, U. S. W. B.*), **Weather Bureau service for Great Lakes shipping during the 1957 navigation season.** *Mariners Weather Log*, Wash., D. C., 2(3):67–68, May **1958. DWB**—On April 1, 1957 Great Lakes weather forecasts (LAFOTS) and weather bulletins (LAWEBS) were first issued for the 1957 navigation season. A list of the weather, warning and radio stations that were engaged, and the major ports affected, are contained in this report. The three major storms of that season appeared between Nov. 7 and Nov. 20 around the Central States and Central Rocky Mountains, the Great Lakes region and the northeastern areas of Texas. Heavy snows, 6 to 12 in., were reported from several points in Upper Michigan and Northern Wisconsin as well as in stations in the Plains States. *Subject Headings:* **1. Storm warning services 2. Great Lakes region, U. S.**—*N.N.*

11.3–171 551.509.52:551.553.8(788)

Williams, Philip Jr. (*U. S. W. B., Salt Lake City*), **Forecasting strong winds at Pueblo, Colorado.** Wash., D. C., U. S. Weather Bureau, June 9, **1958.** 12 p. 8 figs., table. **DWB** (M09.52 U587fo)—An objective method is devised for forecasting strong westerly winds at Pueblo, Colo. Use is made of the early morning Pueblo 10,000-foot wind speed and sea level pressure, and a measure of the north-south pressure gradient through Pueblo. Percentage correct and skill scores are computed for forecasts of wind speeds equal to or in excess of 25, 35, and 45 m.p.h. *Subject Headings:* **1. Wind forecasting 2. Pueblo, Colo.**—*Author's abstract.*

11.3–172 551.509.52:551.515.8(522)

Yamada, S. et al., **Forecasting of instability line and warm type gustwindstorm.** *Journal of Meteorological Research*, Tokyo, 10(6):464–474, June **1958.** 13 figs., 2 tables, 2 refs. In Japanese; English summary p. 464. **DLC**—The authors examined the structure of instability line (nonfrontal squall line) and warm type gust wind storm in winter season, in Kyushu, and obtained a useful work sheet for forecasting them. *Subject Headings:* **1. Gust forecasting 2. Instability line 3. Squall line forecasting 4. Kyushu, Japan.** —*Authors' abstract.*

TEMPERATURE

11.3–173 551.509.532(52)

Imada, M. and Hirano, Y., **Forecasting of late frost in Tokushima Prefecture.** *Japan. Meteorological Agency, Tokyo, Memoirs of Industrial Meteorology*, 20(3):1–6, **1957.** 5 figs., 3 tables. In Japanese; English summary p. 6. **DLC**—When the minimum air temperature falls below 3°C, frost may occur. The distribution of atmospheric pressure when frost occurs is divided into three types from the surface and 700 mb weather maps. In each of the types, the rate of temperature fall is different, and the minimum air temperature of next morning is forecast from the values of wet bulb and dew point temperatures at the moment when the maximum temperature of the day has occurred. The occurrence of frost at various places of the Prefecture is forecast by the use of the relation between the minimum air temperature of Tokushima-shi and those of various places. As the phenomenon of late frost occurs in a fairly wide area, the occurrence of frost in Tokushima Prefecture is closely related to the aerological data of Yonago Weather Station. *Subject Headings:* **1. Late frosts 2. Frost forecasting 3. Tokushima Prefecture, Japan.**—*Authors' abstract.*

11.3–174 551.509.532 551.524.37(759)

*Johnson, Warren O., **Season's report of Federal-State Frost Warning Service (1957–1958?).** Lakeland, Florida, U. S. W. B. and Univ. of Florida Agri. Experiment Stations, May **1958.** 14 p. charts. Also **Report, season 1958–1959.** *Federal-State Frost Warning Service, Lakeland, Fla. Weather Forecasting Mimeo.*, 59-13, April **1959.** 10 p. table, 7 charts. **DWB**—Summary of the meteorological seasonal conditions are given. Low temperatures, high winds and heavy rainfalls were detrimental, but the excellent forecasting and frost warning service demonstrated its inestimable value, attested and commended upon by individual growers and agricultural organizations alike. The activities included collecting data from 400 temperature stations in local fields of the Florida Peninsula. Valuable data and noticeable gains were obtained with regard to the relationships between weather and growth of plants, critical temperature variations for several crops, and finally the effectiveness of a number of protective methods tested. Tabulated data of night temperatures below 36°F and 32°F are presented. Monthly and seasonal rainfalls are recorded. Distribution of forecast is mapped and how to use them is explained. (For abstract on 1955–1956 season, *see* 8.8–176, Aug. 1957, *MAB.*) *Subject Headings:* **1. Frost warning services 2. Lakeland, Fla. I. Federal-State Frost Warning Service, Lakeland, Fla.**—*W.N.*

11.3–175 551.509.532:551.524.2(52)

Sato, Y. and Ikeda, S., **On the forecasting of the temperature distribution on frost night, Pt. 1.** *Japan. Meteorological Agency, Tokyo, Memoirs of Industrial Meteorology*, 20(1):29–41, Oct. **1956.** 13 figs., 3 tables, 12 refs. In Japanese; English summary p. 41. **DLC**—In order to prevent frost damage, it is necessary to forecast the falling tendency and distribution of temperature during a frost night. The authors investigated the forecasting technique according to the following procedures. First, the authors study the method of forecasting minimum temperatures at standard points and extending them to surrounding areas. Next, investigation is made on the method of forecasting the areal mean or minimum temperature for Fukushima Prefecture, and on how to determine the distribution at various places of the Prefecture. *Subject Headings:* **1. Frost forecasting 2. Fukushima Prefecture, Japan.**—*Authors' abstract.*

CLOUDS—PRECIPITATION

11.3–176 551.509.541:551.509.55:551.552(712.7)

Brosch, C. J. and Upton, F. T., **A study of methods of forecasting cloud and fog associated with air flow off Lake Manitoba at Portage la Prairie.** *Canada. Meteorological Branch, CIR-*3218, TEC-305, June 15, **1959.** 12 p. 4 figs., 2 refs. **DWB**—The analysis of data for the autumn months of the years 1953–57 demonstrates that there is a real relation among the factors of surface wind direction, station temperature and Lake Manitoba temperature, affecting the occurrence of stratocumulus or stratus cloud and fog at Portage la Prairie. No attempt was made to explain the details of the physical processes involved other than the assumption that advective warming of the airflow was responsible for the occurrence of stratocumulus

(and cumulus) cloud, and advective chilling for that of stratus and fog. The check made with 1958 data of the critical ranges of wind direction and air/water temperature difference shows that if these had been used in the appropriate instances by the forecaster, occurrence of cloud associated with Lake Manitoba would have been forecast correctly 79% of the cases, on the average, out of a total of 66 instances of wind flow off the Lake. *Subject Headings:* **1. Stratus forecasting 2. Fog forecasting 3. Air flow over lakes—cloud formation relationships 4. Portage la Prairie, Canada.**—*Authors' abstract.*

11.3–177 551.509.55.1:551.575.1

Drexel Institute of Technology, Lab. of Climatology, **Study of time-height variations of micrometeorological factors during radiation fog.** Its *Publications in Climatology*, 10(1):1–51; Contract AF 19(604)-1118, Final Report, **1957.** 51 p. 24 figs. (incl. photos), tables, 76 refs., 14 eqs. Contents: Davis, Francis K., Jr., **The physical processes in the formation of radiation fog,** p. 1–37. (Anon.), **Instrument development,** p. 39–51. **DWB**—The Laboratory of Climatology, Drexel Institute of Technology, New Jersey, in this paper, points out that a thorough knowledge of the physical process which occur before and during the formation of radiation fog is necessary for forecasting its development correctly. Different effects of eddy diffusion, advection, and radiation are discussed. The illustrative data include temperature, wind and dew point profiles in the lowest layers of the atmosphere covering the period before, during and after the formation of radiation fog on 12 occasions. The maximum concentration of water vapor distribution was near the one meter level. By these data facts were gotten on radiational cooling, why and how the dew points fell, the size of the coefficient of eddy diffusion, where the temperature profile indicates a temperature minimum. By them a conclusion has been reached that the critical value of Richardson number for the suppression of turbulence is near 0.15. Under Contract AF 19(604)-1118 instrument development work was conducted and directed toward the production of a series of sensitive, accurate and essentially portable instruments to measure profiles of air and soil temperatures, atmospheric moisture, and wind velocity. The results that were obtained from these instruments were most encouraging for meteorological work. From the field tests it was realized that technicians with rudimentary knowledge of meteorological instrumentation could even operate these instruments. *Subject Heading:* **1. Radiation fog forecasting.**—*N.N.*

11.3–178 551.509.541:551.576

Lavrishchev, D. N., **Obrabotka nabliudeniĭ nad nizkoĭ oblachnost'iu s tsel'iu ispol'zovaniia ikh dlia prognoza.** [The treatment of low cloud observations with the purpose of their use in forecasting.] *Meteorologiia i Gidrologiia*, Leningrad, 7:46–47, July **1957.** fig. **DWB, DLC**—In order to improve the quality of forecasts of low cloud cover it is important to know the statistical relationships between the occurrence of low clouds and air temperature and wind direction and velocity. The author presents a graphical procedure for showing observations on clouds less than 200 m high and illustrates the use of such diagrams in forecasting. The data for constructing the diagram are as follows: date of observation; type of appearance of clouds; minimum height of clouds; wind direction and velocity when clouds appear and when clouds exceeding 200 m appear; air temperature when clouds appear and when clouds above 200 m appear and variations in air temperature for 3–4 hrs up to the appearance of clouds and up to ascent of clouds above 200 m. A diagram (which is reproduced for April 1948–1955 period) is constructed for each month of the year. A detailed description of the diagram is given and its use is illustrated. *Subject Heading:* **1. Low cloud forecasting.**—*I.L.D.*

11.3–179 551.509.542:551.515.4:551.577(52)

Arai T., **On the local heavy rain associated with the thunderstorm of July 22, 1955.** *Journal of Meteorological Research*, Tokyo, 9(7):513–518, July **1957.** 10 figs., table, 3 refs., 3 eqs. In Japanese; English summary p. 513. **DWB, DLC**—Analyses of the vertical cross section from Tango to Wakkanai and local maps were made for the investigation. Some calculations were also made to estimate the distribution of convergence, divergence and ascending velocity of air. As the result of the investigation, it is shown that the synoptic analysis on weather maps, calculation of ascending velocity and estimation of amount of rainfall are necessary but not enough for the practical forecasting of local heavy rain associated

with thunderstorm. *Subject Headings:* **1. Thunderstorm rainfall 2. Rainfall forecasting 3. Synoptic analysis 4. Japan.**—*Author's abstract.*

11.3–180 551.509.542:551.577.2(51)

†Chen, Chi-Kung et al. (*Nanking Univ.*), **The combined deductive-empirical method of local rainfall forecasting and its preliminary testing results in China.** *Acta Meteorologica Sinica*, Peking, 29(3):143–161, Aug. **1958.** 12 figs., 20 refs. In Chinese; English summary p. 161. **DLC**—This paper gives a brief account of the combined deductive-empirical method of forecasting local rainfall. Applications of the method to rainfall forecasting at three local stations in China are also presented. *Subject Headings:* **1. Rainfall forecasting 2. Local forecasting 3. China.**—*Authors' abstract.*

11.3–181 551.509.542:551.577.2(94)

§Foley, J. C. (*Bureau of Met., Melbourne*), **500 mb. contour patterns associated with the occurrence of widespread rains in Australia.** *Australian Meteorological Magazine*, Melbourne, No. 13, 1–18, June **1956.** 8+ figs., 5 refs. **DWB**—Several series of 500 mb contour charts, each with the corresponding surface chart are presented to show upper low, upper trough, cut-off low, deep upper low, and dry period types, in some cases with sub-types showing cyclonic development at surface, or heavy rains in a particular area of Australia. Inset charts show exact distribution and intensity of rain attending each phase of each situation. Remarks or rules as to theory and application to forecasting are included in text along with a description of the general situations (which occurred in 1949, 1950 and 1952). A northerly stream persisting for a day or two, ahead of a trough accompanied by divergence in the 500 mb stream, or the formation of a cut-off low, are necessary for heavy or widespread rains and consequent flooding. *Subject Headings:* **1. Precipitation forecasting 2. Flood forecasting 3. Synoptic case history studies 4. Upper level troughs 5. Cut-off lows 6. Australia.**—*M.R.*

11.3–182 551.509.542:551.511:551.577.2(52)

Fukatani, T., **Divergence analysis of isohyetal pattern accompanied by Bai-u front.** *Journal of Meteorological Research*, Tokyo, 10(7):566–572, July **1958.** 24 figs., ref. In Japanese; English summary p. 566. **DLC**—The author examined the relation between the distribution of daily rainfall amount caused by Bai-u front and the distribution of 700 mb divergence. The results are as follows: (1) A high correlation exists between convergence at 700 mb level and daily rainfall amount: that is, convergence $0–2\times10^{-5}$ sec^{-1} corresponds to rainfall amount 0–30 mm, and $3–5\times10^{-5}$ sec^{-1} to 50–100 mm. (2) Divergence and convergence patterns at 700 mb level move generally from west to east. *Subject Headings:* **1. Rainfall-divergence correlations 2. Bai-u 3. Japan.**—*Author's abstract.*

11.3–183 551.509.542:551.577.32:551.43(945)

Hounam, C. E. (*Central Office, Melbourne*), **Estimation of average annual rainfall over the Port Phillip region of Victoria.** *Australian Meteorological Magazine*, Melbourne, No. 21:1–30, June **1958.** 12 figs., 3 tables, 6 refs. **DWB**—There is shown to be little correlation between average annual rainfall and elevation but consideration of physical principles involved in rainfall production indicates that other factors may have considerable influence on the amount received at a particular location. Orographic features increase the rainfall over favourably located areas and cause a decrease over others whilst elsewhere the distance from the sea may be the most important factor. Over the whole region the bulk of the rainfall is associated with a surface wind having a westerly component. Graphical methods of estimating the influence of each of these factors on average annual rainfall have been developed. Each correction is applied in turn and the resultant estimates are in most cases within 10% of the observed values. Modification of the relationships developed would be necessary before the method could be applied to other regions. *Subject Headings:* **1. Annual rainfall forecasting 2. Orographic effects on rainfall 3. Port Phillip Bay, Australia.**—*Author's abstract.*

11.3–184 551.509.542:551.578.13

*Kusano, K.; Noguchi, K. and Sumino, M., **A practical technique of forecasting orographic precipitation.** *Journal of Meteorological Research*, Tokyo, 9(11):811–822, Nov. **1957.** 8 figs.,

10 tables, 12 refs., 5 eqs. In Japanese; English summary p. 811. **DWB, DLC**—The precipitation amount owing to the orographic upward motion is given by

$$R=\rho_0\sigma_0 A\,\bar{V_0}\cdot\nabla H\cdot\tau-\frac{\sigma_0}{g}\frac{A}{\bar{A}}\Delta p,$$

where A is the damping ratio of orographic upward motion $V\cdot\nabla H$, $\bar{A}$ the average damping ratio between ground level and condensation level, σ_0 the mixing ratio, and τ the duration; other symbols are customary ones. A and $\bar{A}$ were estimated with respect to three waves of topographic profile; 60, 120 and 300 km, which were analyzed from the topographic map of Tohoku District. And the distribution of ∇H in Tohoku District was obtained under same assumptions. The computation of precipitation amount was done on the tracing-paper overlapped on ∇H chart, by means of graphical method. Assuming τ to be 6 hrs, computed values of amount coincided well with observed 6-hr precipitation amount beginning at the time of computation. Thus 6-hr prediction of precipitation amount is possible, and 24-hr prediction will be possible by successive computation. Wind velocity of ground level was estimated by gradient wind approximation. *Subject Headings:* **1. Orographic rainfall 2. Precipitation forecasting.**—*Authors' abstract.*

11.3–185 551.509.542:551.577.37

Lott, George A. (*Hydrologic Services Division, U. S. W. B., Wash., D. C.*), **An appraisal of differential temperature advection and moisture as a forecaster of heavy rainfall.** *Monthly Weather Review*, Wash., D. C., 83(11):267–271, Nov. **1955.** 3 figs., table, 2 refs. **DWB, DLC**—A report on the results of a test of "Gilman's concept of differential temperature advection as a cause of vertical motions in the atmosphere leading to heavy rainfall if sufficient moisture is present." A series of 78 daily forecasts of heavy rainfall was made by using differential temperature advection as a predictor of heavy rainfall. It was found that this method provides a certain skill in determining winter days on which to expect heavy rainfall and where it will occur. "The heavier the rainfall, the greater the probability of its being picked out and the greater the accuracy in the placement of its center." *Subject Headings:* **1. Differential advection 2. Excessive rainfall forecasting 3. Objective precipitation forecasting.**—*I.L.D.*

11.3—186 551.509.542;551.577.21(52)

Marumoto, K., **Objective forecasting of rainfall amount in Hiroshima.** *Journal of Meteorological Research*, Tokyo, 8(11):726–730, Dec. **1956.** fig., 2 tables, 5 refs. In Japanese. **DWB, DLC**—Amount of rainfall in Hiroshima is calculated by obtaining horizontal divergence within a triangular area of vortices with points located at Yonago, Shihonomisaki and Itatsuke. The calculated and actual data from August 1953 to April 1954 are tabulated and analyzed comparatively. The calculated values are valid in the cases of warm front and stationary front type rain except passing of cold front and closed front. *Subject Headings:* **1. Objective rainfall forecasting 2. Rainfall amount 3. Hiroshima, Japan.**—*Jay Woo.*

11.3–187 551.509.542:551.577

Milata, Władysław, **Synoptyka wielkich opadów atmosferycznych.** [Synoptics of abundant precipitation.] *Przegląd Meteorologiczny i Hydrologiczny*, Warsaw, 8(3/4):210–217, **1955.** 5 figs., 4 refs. English summary p. 216–217. **DWB, DLC**—In spite of the shortage of observational data due to the scarcity of meteorological stations and completed studies of individual occurrences, the author succeeded in separating out five principal types of weather situations leading to abundant storm rainfall in the Carpathian Mountains. Most of them occur in the period of summer monsoons. The first four are characterized by intrusions of humid air masses from the north whereby the frontal effects are amplified by the orography of the area. Forecasts can be made 12–48 hrs in advance, but the difficulties of preparing them vary with each type. The forecasting of thermal thunderstorms (type 5) is especially difficult. The author adds that correct forecasting can be achieved only when complete synoptic, geographical and hydrological data are available to the forecaster. *Subject Headings:* **1. Precipitation forecasting 2. Weather types.**—*A.M.P.*

11.3–188 551.509.543:551.578.71:551.574.

Palomares Casado, Manuel, **Transformaciones físicas de los esferocristales en las granizadas.** [Physical changes in the spherical crystals in hail.] *Revista de Geofísica*, Madrid, 17(65):15–28, Jan./March **1958.** 9 refs., 42 eqs. Spanish and English summaries p. 15–16. **DWB?**—In this work the author studies the physical variations which the large solid, ice spheres may go through on passing through the layers of clear air which lie between the base of the cloud, in which they were formed, and the ground. These solid ice spheres are produced by the forced convection of the heat and the condensation or evaporation of water vapor. Formulas are given to determine their changes of volume in time or in space, and uses them to calculate special cases, pointing out afterwards the basic theory to complete the technique to forecast the sizes of the hailstones on reaching the ground or a certain level, by knowing their characteristics on leaving the cloud and by determining the physical conditions of the lowest air layers. *Subject Heading:* **1. Hailstone size forecasting.**—*Author's abstract.*

11.3–189 551.509.542:551.501.81

Ryan, P. (*Met. Office, Townsville*), **Use of rareps in short period precipitation forecasts.** *Australian Meteorological Magazine*, Melbourne, No. 15:42–48, Dec. **1956. DWB**—Using the bearing, distance and nature of precipitation observed on the radar at Townsville for the four months January–April, 1956, at the hours of 0430 and 0700 G.M.T., the known direction of the upper winds as obtained from the 0400 G.M.T. rawin flight and the type of clouds observed at 0400 and 0700 G.M.T. a precipitation forecast was made for the periods 0500–1100 G.M.T. and 0800–1400 G.M.T., respectively and these forecasts were compared with the actual ensuing weather. *Subject Heading:* **1. Precipitation forecasting with radar.**—*Author's abstract.*

11.3–190 551.509.542:551.558:551.509.25

Sassman, J. M. and Allen, R. A. (*both, U. S. Weather Bureau, Wash., D. C.*), **Forecasting precipitation occurrence from prognostic charts of vertical velocity.** *Monthly Weather Review*, Wash., D. C., 86(3):95–99, March **1958.** 4 figs., 5 refs. **DWB, DLC**—An empirical study is made of the relationship of precipitation occurrence to vertical velocity and dewpoint depression. Based on this work a method of forecasting precipitation occurrence is developed. The method uses two predictors, the prognostic charts of 500 mb vertical velocity made by the JNWP Unit with a thermotropic model, and the dew point depression. Tests of the method suggest it is widely applicable in the eastern U. S. *Subject Headings:* **1. Precipitation forecasting 2. Vertical velocity charts 3. Prognostic charts.**—*Authors' abstract.*

11.3–191 551.509.542:551.577.37(540)

Sinha, K. L., **On forecasting heavy rainfall in Malabar, South Kanara and Travancore-Cochin during June and July.** *Current Science*, Bangalore, 25(10):335–336, Oct. **1956.** table, 2 refs. **DWB, DLC**—A simple objective method for forecasting heavy monsoon rainfall over Malabar, South Kanara and Travancore-Cochin during June and July was found by tabulating pressure differences between Calicut (Kozhikode), Mangalore and Ootacamund (hill station) at 0.8 h local time against rainfall of 2.0″ or more in the subsequent 24 h (for 1937–40). Heavy rain in Malabar, S. Kanara and Travancore-Cochin in June and July can be forecast from pressure differences at the 3 stations when (a) the difference between Calicut and Mangalore is .100″ and when (b) pressure at Ootacamund is 23.015″ or less and the pressure difference of (a) is .070″ or more. *Subject Headings:* **1. Objective rainfall forecasting 2. Monsoon rainfall forecasting 3. Pressure difference-rainfall relationships 4. India.**—*M. R.*

11.3–192 551.509.542:551.577.37(522)

Sugiura, S., **Forecasting of heavy rainfall by premigram.** *Journal of Meteorological Research*, Tokyo, 7(11):717–725, Dec. **1955.** 9 figs., table, 3 refs., 4 eqs. In Japanese; English summary p. 717. **DWB, DLC**—If an air mass in a state of convective instability is brought upward and reaches the level where it becomes stable, it is expected that the large amount of water vapor will be condensed. This idea is consolidated into the "premigram" devised by K. Wadati (1940). Using this diagram, the author has attempted the computation of the amount of precipitable water for the heavy rainfall in Kyushu on June 25–29, 1953. This result is in good agreement with the observed amount of rainfall and this result shows that the

amount of precipitable water released by unstable air would be a decisive factor in case of the heavy rainfall frequently observed in Japan during summer season. *Subject Headings:* **1. Excessive rainfall forecasting 2. Premigram 3. Nomograms 4. Kyushu, Japan.**—*Author's abstract.*

11.3–193 551.509.542:551.577.2:551.579.1(522)

Yamada, S.; Ōtsubo, S. and Danjō, T., **A study on quantitative forecasting of precipitation amount in Kyushu District, Pt. 3.** *Journal of Meteorological Research*, Tokyo, 8(9):574–580, Oct. 1956. 11 figs., 3 tables, 7 refs. In Japanese; English summary p. 574. **DWB, DLC**—The authors investigated statistically the relation between the intensity of westerly trough and the depth-duration-area (D.D.A.) values in Kyushu, and obtained the following results: 1) The authors have chosen three cases of trough on upper charts in each season, the intensity of which was determined from the variation of 850 mb height at Kagoshima, and the altitude difference of 850 mb between Kagoshima and Itazuke in the rainy season. But, between the intensity of trough in these three cases and the D.D.A. values in Kyushu, particularly close correlation has not been found. 2) The authors have used the total values of two south-components of wind velocity at 1.5 km and 3.0 km levels at Kagoshima, because the magnitude of "north-south exchange" by the meridional component of upper wind velocity has represented the intensity of westerly trough that corresponds to the amount of rainfall in Kyushu. Thus, the relationship between the magnitude of south component and the D.D.A. values in Kyushu has shown a passably good correlation. Thereupon, it is found that the utilization of the south-component of wind velocity is an effective method for the objective quantitative forecasting of precipitation. 3) In summer, however, the vertical shear of the south-component of wind velocity has much importance for the objective quantitative forecasting of precipitation in Kyushu. *Subject Headings:* **1. Quantitative rainfall forecasting 2. Kyushu, Japan.**—*Authors' abstract.*

11.3–194 551.509.542:551.554(547.1)

Rai, D. B. (*Regional Met. Center, Bombay*), **Effect of vertical wind shear on rainfall at Poona during south-west monsoon.** *Indian Journal of Meteorology and Geophysics*, New Delhi, 9(1):92–94, Jan. 1958. table, 6 refs. **DWB, DLC**—Using the theory of air flow over mountains, the author explains the objective methods of forecasting rain in Poona during the south-west monsoon which involves two parameters: the difference between the sea level pressures at Honavar and Bombay (A) and the difference between the one gpkm pressures at Mahabaleshwar and Poona (B). The criteria obtained are if $A > B$, greater chances of rain; if $A < B$, chances of rain are small. The explanation is developed with reference to the gpkm pressure difference between Gadag and Poona, for the B parameter. Criteria for increase or decrease of rain on the lee side of the Ghats may be put as: forward wind shear $\partial u/\partial z > 0$; decrease in rains; reverse wind shear $\partial u/\partial z < 0$, increase in rain. An analysis of the pressure differences between the two coastal places representing conditions at sea level and the one gpkm pressure difference between the stations to the east of the Ghats or representative of conditions of the gpkm, leads to the conclusion that when the pressure difference between Gadag and Poona is less than between Honavar and Bombay there should be increase of rain and vice versa. *Subject Headings:* **1. Vertical wind shear effects on rainfall 2. Rainfall forecasting 3. Objective forecasting 4. Poona, India.**—*I.L.D.*

FOG

11.3–195 551.509.55:551.575

Epinat'ev, M. N., **K voprosy o diagnoze i prognoze tumana.** [The problem of diagnosing and forecasting fog.] *Meteorologiia i Gidrologiia*, Leningrad, No. 6:25–29, June 1958. 3 figs., 5 tables, eqs. **DWB, DLC**—The fundamental cause of failures in forecasting fogs by the method of comparing forecast minimum air temperatures with computed temperature of fog formation is the failure to take into account the variation in the moisture content of the air at the ground layer and also the absence of a reliable method of forecasting minimum air temperature. The vertical exchange in the ground layer in fog was investigated by means of temperature soundings; and 140 cases of radiosounding of the atmosphere carried out at Smolensk during 1912–53, are analyzed. As a rule fog is accompanied by an atmospheric tem-

perature inversion. During the fog the specific humidity of the ground layer of the atmosphere increases with height or remains practically constant, in addition there is a transport of moisture from the upper to the lower layers of the atmosphere favoring the formation of fog and its maintenance. When the gradient of specific humidity and temperature in the atmospheric layer near the ground is positive, the flow of moisture is directed to the higher layers of the atmosphere and fog does not form. The use of Zverev graphs or emagrams to forecast fog is limited since the moisture at the surface of the earth is variable. For a more exact forecasting of fog a supplementary graph is proposed. Its construction and use are described and numerical data on the frequencies of different values of vertical temperature inversions, and different curves of atmospheric stratification in various fogs in the first 1500 m of the atmosphere are presented. *Subject Heading:* **1. Fog forecasting methods.**—*I.L.D.*

11.3–196 551.509.55:551.575(567)

*Iraq, Meteorological Dept., **Fog forecasting aid for Baghdad Airport.** Its *Current Investigations*, No. 1, **1956.** 4 p. forms, 6 tables. Mimeo. **DWB** (M92.2/567 I65cu)—The forecasting aids were developed in the research section of the Iraqi Meteorological Department from correlations empirically found between various elements. Fog forecasting procedure is given thus: reading of actual temperature and dew point at 15 G.M.T.; classification of air mass expected during the night, forecasting of cloudiness and wind for the night, temperature course during the night, the most probable change of the dew point, the time fog will probably start, and the time fog probably will end. Forms and tables are provided for each of these. *Subject Headings:* **1. Fog forecasting methods 2. Baghdad, Iraq. I. Lingelbach, Ernst II. Al Madfai, Abdul Majid Faik III. Ahmad, Ibrahim.**—*N.N.*

11.3–197 551.509.55:551.551.575:551.594.11

Serbu, G. P. and Trent, Eva Mae (*both, U. S. Naval Res. Lab., Wash., D. C.*), **Study of the use of atmospheric-electric measurements in fog forecasting.** *American Geophysical Union, Transactions*, 39(6):1034–1042, Dec. **1958.** 9 figs., 4 tables, 12 refs. **DWB, DLC**—A statistical study of atmospheric-electric and pertinent meteorological data collected in Argentia, Newfoundland, from January through September, 1955, shows that fogs produce a decrease in the electrical conductivity with a concurrent increase in potential gradient. A quantitative analysis of the data shows that during fog (horizontal visibility less than ½ mi, ceiling less that 200 ft) the average conductivity was less than 0.65 times the monthly mean 92% of the time and the average potential gradient was more than 2.0 times the monthly mean 87% of the time. From one to two hours preceding the onset of fog the conductivity decreased and the potential gradient increased in about 70% of the events. One hour prior to dissipation of fog conductivity increased and potential gradient decreased in 75% of the events. Similar studies should be made in additional areas to determine whether the Newfoundland results are unique or may be encountered more generally. *Subject Headings:* **1. Potential gradient variations during fog 2. Electrical conductivity measurements 3. Fog forecasting methods.**—*Authors' abstract.*

11.3–198 551.509.55:551.575.1:551.571.3

Szepesi, Dezsö, **A kisugárzási ködök keletkezésének összefüggése a harmatpont változásával.** [Relation of radiation fog formation to dew point variations.] *Időjárás*, Budapest, 61(5):339–346, Sept./Oct. **1957.** 9 figs., 5 refs. Hungarian and German summaries p. 339. **DLC**—Two types of dew point variation (dry and moist type) are described and their relations to temperature variations and to fog formation are treated graphically. Empirical diagrams for predicting fog formation from temperature and dew point data are presented. The effect of wind is considered. *Subject Headings:* **1. Dew point variations 2. Dew point-radiation fog relationships 3. Radiation fog forecasting.**—*G.T.*

THUNDERSTORMS AND SEVERE STORMS

11.3–199 551.509.56:551.515.4(494)

Cantù, Vittorio, **Contributo al problema della previsione dei temporali.** [Contribution to the problem of thunderstorm forecasting.] *Rivista di Meteorologia Aeronautica*, Rome,

8(4):26–30, Oct./Dec. **1958.** 2 figs., table, 3 refs. Italian, French, English and German summaries p. 26. **DWB**—The results of some statistical researches concerning thunderstorm forecasting by considering some data (instability, dewpoint, wind and others) are reported here. These researches were carried out in Switzerland, in 1957, at the Meteorologische Zentralanstalt, in Zürich. *Subject Headings:* **1. Thunderstorm forecasting 2. Zurich, Switzerland.**—*Author's abstract.*

11.3–200 551.509.56:551.594.221

Lindquist, H. D., **Summer lightning storm forecasting in eastern Washington.** Seattle, Wash., Weather Bureau Airport Station, Fire Weather Service, Seattle-Tacoma Airport, March **1958.** 7 p. 6 figs., 2 tables, 5 refs. **DWB** (M09.54 U587su)—During the summer months in the eastern parts of the State of Washington where humidity is very low at that time, the U. S. Forest Service, the U. S. Indian Service and the Department of Natural Resources (of the State) are concerned with the protection of the various districts from fire. Lightning storms occur within the area on an average of more than half the days in July and August. This is a report on an objective study carried out in order to develop a method of forecasting summer lightning storms occurring from 8 a.m. to midnight of the current day. Details of the investigation, the parameters tested and those incorporated into the objective forecasting system are presented. An illustrative example of the parametric data has been cited for Ellensburg during the July–August 1950–57 period. It has been accepted that summertime lightning storms are frequently associated with weak surface fronts or upper troughs. A map of the State illustrating the areas in question and charts on lightning storms during July-August 1953–57 are included. Methods adopted here should be used in the morning forecasts. *Subject Headings:* **1. Thunderstorm forecasting 2. Lightning storm frequency data 3. Washington (State).**—*N.N.*

11.3–201 551.509.56:551.515(778)

Severe weather. *Flying Safety*, Wash., D. C., 14(4):2–4, April **1958.** figs., table. **DWB**—An example of a severe weather advisory issued by the Severe Weather Warning Service at Kansas City, Mo., and a summary of the information usually contained in these advisories is given briefly for Air Force pilots. These warnings give advice on areas in which the most dangerous thunderstorms are expected (in terms of gusts, hail and turbulence), tornado areas, etc., and how these advisories are used in preparing detailed flight plans so as to avoid the worst weather, and by the Flight Advisory Weather Service (FAWS). Even in winter the service is important for the severe storms are more often encountered unexpectedly and move faster. *Subject Headings:* **1. Severe storm advisories 2. Severe Weather Warning Service 3. Kansas City, Mo.**—*M.R.*

TROPICAL CYCLONES

11.3–202 551.509.57:551.515.2(759)

Ballenzweig, Emanuel M. (*Extended Forecast Sec., U. S. W. B.*), **30-day hurricane probability statements.** *Mariners Weather Log*, Wash., D. C., 1(5):122–123, Sept. **1957. DWB** – The Hurricane Warning Centers at Miami, Fla., have been issuing twice each month, on an experimental basis, 30-day hurricane probability statements for areas along the Gulf and Atlantic coasts. Work in this field was started in mid-June 1957 and the first experimental statement was issued in the same month. By this combined effort, the best estimate of the probability of hurricane occurrences, based on statistical and synoptic considerations can be made. *Subject Headings:* **1. Hurricane probability statements 2. Hurricane forecasting 3. Miami, Fla.**—*N.N.*

11.3–203 551.509.57:551.515.23(94)

Bath, A. T.; Lloyd, S. H. and Ryan, P. (*all, Bur. of Meteorology, Australia*), **Practical techniques used in the Australian region for tropical cyclone forecasting.** (In: Tropical Cyclone Symposium, Brisbane, Dec. 1956, **Proceedings.** Pub. Dec. **1956.** p. 121–133. 14 figs., 2 tables, 13 refs.) **DWB**—An outline is given of techniques used with the available reporting network for detection, development and movement of cyclones in the Australian

region. Where networks are scanty, some comments are made on other aids which might b used to infer development. A fairly detailed description is given of the passage of a wave i the easterlies and of the fracture of an extended trough. It is concluded that streamlin analysis, time sections and upper air charts are valuable tools in tropical cyclone detection an forecasting, but deficiencies in the surface and upper air networks in low latitudes seriousl limit the application of these techniques. *Subject Headings:* **1. Tropical cyclone forecastin 2. Forecasting techniques 3. Australia.**—*Authors' abstract.*

11.3–204 551.509.57:06:355.353 551.509.31

Brango, Nicholas (*U. S. Navy*), **Navy participation in the United States hurricane warnin service.** (In: Tropical Cyclone Symposium, Brisbane, Dec. 1956, **Proceedings.** Pub. Dec **1956.** p. 119–120.) **DWB**—Roles of the U. S. Navy's Typhoon Tracking Center at Guam the Hurricane Tracking Center at Miami and the Navy Weather Central in hurricane o typhoon reconnaissance and forecasting, of Project AROWA in research on forecasting, and o the ONR (Office of Naval Research) in investigating forecasting problems such as numerica weather predictions, high level balloon and rocket soundings, automatic weather stations, ar outlined. *Subject Headings:* **1. Hurricane warning services 2. Hurricane reconnaissance 3. Typhoon reconnaissance 4. U. S. Navy Typhoon Tracking Center, Guam 5. U. S. Navy Hurricane Tracking Center, Miami 6. Numerical forecasting.**—*M.R.*

11.3–205 551.509.57:551.515.23(94

§Hannay, A. K. and Phillips, E. F. (*both, Bureau of Met., Australia*), **Tropical storm movement-case studies from the 1955–56 summer in the Australian region.** (In: Tropical Cyclone Symposium, Brisbane, Dec. 1956, **Proceedings.** Pub. Dec. **1956.** p. 309–323. 16 figs., table, 14 refs.) **DWB**—This paper investigates the application of certain techniques used in the prediction of tropical storm movement. Fifteen or so storms of the 1955–56 summer in Australia are examined. At the outset three case studies show the application of high level steering, SIMPSON'S warm tongue and other techniques. A summary is given for the remaining tropical storms showing the forecasting principles giving the most useful results in each case. It is concluded that steering level and secondly warm tongue steering offer the most practicable approach to the problem of 24 to 48 hr prediction of motion at the present time. *Subject Headings:* **1. Tropical storm movement forecasting 2. Australia.**—*Authors' abstract.*

11.3–206 551.509.57:551.515.23(265/266)

Hunter, J. A. (*N. Z. Met. Service, Nandi Airport, Fiji*), **Prediction of hurricane tracks in the South Pacific.** (In: Tropical Cyclone Symposium, Brisbane, Dec. 1956, **Proceedings.** Pub. Dec. **1956.** p. 355–358. 4 refs.) **DWB**—Attempts have been made to apply to the South Pacific oceanic area quantitative methods of predicting hurricane tracks. The lack of success attending these efforts is attributed in the main to the sparsity of upper air observations. It is concluded that, until more upper air observations are available, the key to satisfactory qualitative cyclone forecasting in this area lies in striving for more accurate surface isobaric analysis. *Subject Headings:* **1. Hurricane track forecasting 2. South Pacific.**—*Author's abstract.*

11.3–207 551.509.57:551.515.2:681.14

Jamison, Marshall V. (*1st Weather Wing, U. S. A. F.*), **Typhoon research and forecasting methods in the 1st Weather Wing, United States Air Force.** (In: Tropical Cyclone Symposium, Brisbane, Dec. 1956, **Proceedings.** Pub. Dec. **1956.** p. 97–118. 14 figs., 5 tables.) **DWB**—Current typhoon forecasting practice at the typhoon forecasting centers of the 1st Weather Wing is described. A checklist-worksheet for typhoon forecasting provides a means to insure that forecasters consider all the factors believed to be of greatest value in forecasting typhoon movement and speed. A typhoon analogue method of forecasting which utilizes International Business Machines to select typhoons analogous to the current one is described in some detail and examples are given. Overall typhoon forecasting accuracies of the 1st Weather Wing are given. Accuracies of GRIFFITH WANG'S method and of post-analysis

extrapolation and climatology are also given. A program wherein forecasters assigned to weather reconnaissance squadrons as crew members participate in limited scope typhoon studies, based on their unique opportunities, is discussed and symposium participants are invited to suggest limited scope projects. Finally, the author presents his personal view that advancements in radar meteorology, improvements in temperature and humidity measurements in both the vertical and horizontal and improved methods to measure sea surface temperature open the possibility of determining much more quantitatively where water vapor is condensing and where it will condense. As the source of energy of the tropical cyclone, and as a source which can create pressure changes, the location and intensity of precipitation frequently must influence significantly the direction and speed of movement and intensity of the tropical cyclone. Forecasting tools should be developed so that operational forecasters can take these energy considerations into account. *Subject Headings:* **1. Typhoon forecasting 2. Typhoon movement 3. Machine methods.**—*Author's abstract.*

11.3–208 551.509.57:551.515.2:06

U. S. Weather Bureau. Forecasts and Synoptic Reports Division, (*comp.*), **The Weather Bureau's hurricane warning service.** *Mariners Weather Log*, Wash., D. C., 1(4):71–73, July **1957.** fig. **DWB**—There are seven Hurricane Forecast Centers along the east coast, two on the west coast and one in the Hawaiian Islands. At these centers, the forecasters plot and analyze weather reports which form the basis of issuing warning of tropical storms and hurricanes as they progress. Details and special tropical storm reports for ship captains and mates are included in the reports. *Subject Heading:* **1. U. S. W. B. Hurricane Warning Service.** —*N.N.*

11.3–209 551.509.57:551.515.23

Veigas, Keith W.; Miller, Robert G. and Howe, George M., **Probabilistic prediction of hurricane movements by synoptic climatology.** *Travelers Weather Research Center, Occasional Papers in Meteorology*, No. 2, June **1959.** 54 p. 14 figs., 5 tables, 6 refs., eqs.—An analysis of the variance procedure used in testing the hypothesis associated with the prediction of the movement of hurricanes. The significance of the circulation pattern over and above past movements of such hurricanes has been tested from the study of the storms from 1924 through 1927 and 1954 through 1956. The study is intended to recast climatological data on hurricanes in the form that is more directly applicable to the weather prediction problem. Synoptic weather patterns are tabulated and discussed, especially the surface circulation pattern as depicted by sea-level pressure distribution. *Subject Headings:* **1. Hurricane movement forecasting 2. Synoptic patterns.**—*N.N.*

FIRE WEATHER

11.3–210 551.509.58 632.187

Cramer, Owen P., **Using fire-weather forecasts and local weather observations in predicting burning index for individual fire-danger stations.** *U. S. Forest Service, Pacific Northwest Forest and Range Experiment Station, Research Paper*, 28, July **1958.** 33 p. 2 figs., 11 tables. **DWB** (M:6349 C89us)—Several evaluating procedures for the prediction of fire danger in forests are demonstrated and discussed here. Field testing of different aids was held at six ranger districts during the fire season July 1–Sept. 15, 1950. The regions represented different climatic conditions and the tests were conducted by the regular personnel at the stations with a minimum of assistance from the scientific researchers. The results of forecasting wind speed, relative humidity and fuel moisture changes from graphical aids are reflected in the burning index (BI) presented. Weather observations, reporting, recording and predicting the BI at 14 ranger districts averaged 1 hr 32 min per day of which 9 min was the average for the BI prediction per fire danger station. At 21 ranger districts, without the aids, 1 hr 10 min was spent for weather and fire danger rating, prompting simplification by consolidating all aids for each station on a single sheet. This simplification now enables experienced personnel to predict wind and fuel moisture in less than 2 min per station. Detailed graphs and tables are given. *Subject Headings:* **1. Fire danger rating 2. Fire weather forecasting 3. Burning index data.** —*W.N.*

11.3–211 551.509.542:634.9

Rystedt, G., **Weather forecasts for slash-burning.** Two articles from *Skogen*, 39(6):141–142, June 1, **1952,** and from 40(6):113, June 1, **1953.** Full transl. from Swedish by A. A. Robertson, issued as **Pulp and Paper Research Institute of Canada, Montreal, Translation Series,** No. 12, Feb. **1956.** 4 p. Photostat. **DWB** (M:634.9 R996we)—During the summers of 1951 and 1952 the weather service of Sweden issued special weather forecasts for slash-burning by radio every week-day at 6:35 and 8:05 a.m. for 20 different forecast districts of Norrland. The precip. forecasts proved generally satisfactory, especially in 1952. The main problem is that of predicting the time and location of showers which make slash-burning difficult. *Subject Headings:* **1. Slash-burning weather forecasts 2. Precipitation forecast for slash-burning 3. Norrland, Sweden. I. Robertson, A. A.** (*transl.*)—*M.R.*

11.3–212 551.509.58:632.187(943)

Whittingham, H. E. (*Divisional Office, Brisbane*), **Errors in forecasting maximum temperature and dew point for Southeast Queensland, 1956 with application to fire weather conditions.** *Australian Meteorological Magazine*, Melbourne, No. 20:16–29, March **1958.** 2 figs., 5 tables, 4 refs. **DWB.** Also in: Fire Weather Conference, Melbourne, Australia, July 1958, **Proceedings,** issued Melbourne, **1958.** Conference Paper, No. 12 (19 p.) fig., 5 tables, 4 refs. **DWB**—The error distributions of forecasts of maximum temperature and dew point made in the fire season of 1956 for southeast Queensland stations are examined and it is found that the fire danger rating could be accurately foretold on at least 85% of occasions. *Subject Headings:* **1. Maximum temperature forecast errors 2. Dew point forecasting 3. Fire weather forecasting 4. Southeast Queensland, Australia.**—*Author's abstract.*

FLYING WEATHER

11.3–213 551.509.58:551.576.4(788)

*Brown, Merle J. and Tillotson, Kenneth C. (*both, U. S. W. B., Denver, Colo.*), **Forecasting ceilings at Denver, Colorado.** *American Meteorological Society, Bulletin*, 38(4):193–205, April **1957.** 19 figs., 4 tables, 7 refs. **DWB**—Objective forecasting techniques are established for the average value of the ceiling at Denver of duration of three consecutive hourly observations or longer during the 6-hr period beginning 6 hrs after the surface map used. Due to marked diurnal effects on ceilings and forecast variables, the study is divided into two parts: one for the forecast period 1130–1730M from the 0530M map, and the other for the forecast period 2330–0530M from the 1730M map. Persistence of ceiling at forecast preparation time (0830M and 2030M) shows such a strong relationship to subsequent ceiling occurrences that rather extreme stratification is necessary to improve upon a simple "persistence" forecast. *Subject Headings:* **1. Ceiling height forecasting 2. Objective forecasting techniques 3. Denver, Colo.**—*Authors' abstract.*

11.3–214 551.509.58:629.13(672)

Delnott, M.; Giboin, M.; Jeandidier, M. et al., **Études des trajets aériens.** [Studies of air routes.] *France. Météorologie Nationale, Monographies*, No. 5, Oct. **1957.** 36 p. charts. Contents: Brazzaville-Villa-Luzo. Brazzaville-Douala. Brazzaville-Bangui. Bangui-Fort-Lamy. **DWB**—Routine route forecast study of 4 routes emanating from the French Congo. The dry season is May–Oct. and the rainy season Oct.–mid-May. Weather types include: 1) those without disturbances, when the diurnal regime is dominant, and 2) the type when a line of squalls moves East to West. Winds aloft, cross sections (flight forecast forms) and a discussion of local weather peculiarities in each route are presented. *Subject Headings:* **1. Air route forecast studies 2. French Congo. I. Rougeolles, M.**—*M.R.*

MISCELLANEOUS PHENOMENA

11.3–215 551.509.58:06:656.1

Belgium, Force Aérienne. Service Météorologique, **La météorologie au service des usagers de la route.** [Meteorology in the service of users of roads.] Its *Manuel* No. 25, Oct. **1957.** 35 p., 5 figs.—The organization of the road condition forecasting service is de-

scribed. Observation of road condition, codes and procedures used, transmission of road observations, writing up of road bulletins, dissemination of information, and relations with neighboring countries are discussed. *Subject Headings:* **1. Applied meteorology 2. Road condition forecasting 3. Meteorological services 4. Belgium.**—*A. V.*

11.3–216 551.509.59:551.552:551.507.321.2

Franceschini, Guy A., **Study of variations of balloon trajectory patterns.** Texas. Agricultural and Mechanical College. Dept. of Oceanography and Meteorology, Contract AF 19(604)-2222, Final Report, Oct. 1958. 23 p. **DWB**—Work under this contract consisted of studies and experimental investigations directed toward the determination of: (a) methods and techniques for predicting balloon trajectories applicable to operational use, and from normally available analyses, data and prognoses; (b) the dynamics of air trajectories; (c) methods of utilizing balloon flight data in the preparation of forecasts of important weather elements. A major part of the effort was concerned with new approaches to the basic problem of trajectory predictions. In one approach, a method of objective analysis was derived in order to minimize errors in initial input conditions of pressure and wind resulting from subjective analyses. A second approach treated the motion of a balloon as that of a closed system. This study, based on the variation principle, considered horizontal motion, and accounted for continuity effects. Comparison of predicted with observed balloon accelerations showed improvement over "particle dynamics" treatments. Further theoretical work was done on a method of solving the modified primitive equations by the introduction of potentials. Considerable time was given to the operational use of predicted trajectories for diagnostic and prognostic purposes. Results of studies on the use of a trajectory chart for obtaining divergence were encouraging. Divergence patterns determined this way showed excellent correlation with motion and changes of selected pressure systems. Based on the trajectory chart, studies on precipitation, and subtropical flow patterns were initiated but are not completed at this time. Preliminary results were obtained on a study concerned with predicting the wind field using a Lagrangian approach. A numerical method was developed which utilizes normally available analyses or prognoses. Sample predictions were made, using an IBM-650, for three case studies. Although the results, as yet, are not satisfactory, they give some insight to the problem of dynamics of air parcels. A minor effort was made to determine methods of using balloon flight data. The study (Master's Thesis) was concerned with wind and pressure gradient determinations; another, preliminary in nature, was concerned with use of balloon data in objective map analyses procedures. *Subject Heading:* **1. Balloon trajectory forecasting.**—*Author's abstract.*

11.3–217 551.509.58:551.510.42:533.15

Hahn, Gerald J. (*Dugway Proving Ground*), **Statistical methodology in predicting gaseous diffusion.** (In: U. S. Dugway Proving Ground, **Symposium on micrometeorology turbulent diffusion, June 28–29, 1954.** pub. 1956. p. 71–91.) **DWB**—Results of 38 tests (over 6 months period) made at the Tower Grid at Dugway, using different meteorological parameters, showed that only 3 of these proved to be sufficiently significant in predicting dosages of pollutants at ground, namely: wind speed at 8 in. (59% of variation could be accounted for by use of this one parameter); state of ground (dry ground correlated best with dosage, and wind speed plus state of ground accounted for 75% of variation); temperature (high temperature, associated with high dosage, and combined with 2 former parameters accounted for 83% of variation). Lapse rates, relative humidity, vapor pressure, atmospheric pressure, solar radiation, temperature or wind at different heights, turbulence, and cloud cover did not add to the above correlations although taken individually they showed some significance. *Subject Headings:* **1. Diffusion of stack effluents 2. Statistical gaseous dosage forecasting 3. Wind speed effects on diffusion 4. Tower Grid, Dugway, Utah.**—*M. R.*

11.3–218 551.509.58:551.586:634.23(522.7)

Kamijo, Kazuichi, **A note on the prediction of the flowering dates of cherry blossoms (*Prunus yedoenis Matsum*) at Kagoshima.** *Journal of Meteorological Research*, Tokyo, 9(10):750–751, Oct. 1957. fig., 2 tables. In Japanese. **DWB, DLC**—The flowering dates of cherry blossoms in Kagoshima from 1927–1954 (except 1934, 1946–1949) range from March

24th to April 10th; air temperature ranges from 9–18°C, average value of 13°C. Empirical equations for estimating flowering date with weather elements are discussed with the tabulation of air temperature at flowering dates. *Subject Headings:* **1. Cherry blossom forecasting 2. Cherry blossom phenology 3. Kagoshima, Japan.**—*J. Woo.*

11.3–219 551.509.58:551.510.42

Kauper, Erwin K.; Holmes, Raymond G. and Street, Arthur B., **Meteorological variables and objective forecasting techniques relating to the air pollution problem in Los Angeles.** *Los Angeles (County). Air Pollution Control District, Technical Paper*, No. 15, July **1955**. 15 p. 12 figs. **DWB** (M10.42 L879tp)—While the weather conditions responsible for the air pollution problem in Los Angeles are, in general, well known, a more precise picture of the effect of these conditions is needed in order to provide sufficiently detailed forecast of air pollution intensity. About 90% of the heavy air pollution attacks occur in the five months of July through November. However, heavy attacks do occur in all seasons, each season having its particular combination of weather elements that produce different types of air pollution attacks. In forecasting air pollution intensities, two techniques have proved to be useful. Using the height of the inversion base and the strength of the inversion, a nomogram of air pollution intensity has been prepared. This method ignores the effect of wind flow. Comparison is made of this system with one based on pressure and temperature gradients between a coastal and inland station. This latter method indirectly takes into account both the inversion conditions and the wind flow, and shows a good verification when used in the 1954 air pollution season. *Subject Headings:* **1. Objective forecasting 2. Air pollution forecasting 3. Los Angeles, Calif.**—*Authors' abstract.*

11.3–220 551.509.58:551.510.42(768)

§Kleinsasser, T. W. and Wanta, R. C., **Development of a forecasting service for use in air pollution control.** Presented at the Air Pollution Control Association meeting, Buffalo, N. Y., May 21, **1956**. 17 p. 2 plates, 2 graphs, table, 9 refs. **DWB** (M10.42 K64de)—A meteorological study based on an air pollution survey at Kingston, Tenn., during June 29 to Oct. 26, 1954. A forecasting service was developed to allow controls to be effected by plant operators whenever conditions warranted. A case study (Oct. 19–26, 1954) is described to show operations and efficacy of the system. *Subject Headings:* **1. Atmospheric pollution forecasting service 2. Atmospheric pollution surveys 3. Specialized forecasts 4. Kingston, Tenn.**—*M.R.*

11.3–221 551.510.721:551.509.58

Machta, Lester (*U. S. W. B., Wash., D. C.*), **Discussion of meteorological factors and fallout distribution.** *U. S. Atomic Energy Commission, HASL (Health and Safety Lab.)*, No. 42:310–325, Oct. **1958**. 15 figs., 13 refs. **DWB** (M94.143 U581en)—This report discusses the meteorological principles involved in the prediction of local fallout, the intermediate and delayed stages of the fallout. In order to trace the atmospheric motions of recent fallout, certain experiments were undertaken from which it was conclusively proven that meteorological theory is involved in the proper prediction of any future fallout. Details of this investigation cover many observations from different parts of the world. *Subject Headings:* **1. Radioactive fallout pattern forecasting 2. Meteorological effects on radioactivity.**—*N.N.*

11.3–222 551.509.59:551.515:551.513(5-012)

Tomioka, S., **An empirical formula for the wave length of stationary long wave over the Far East.** *Journal of Meteorological Research*, Tokyo, 10(1):53–56, **1958**. 5 figs., 7 refs., 5 eqs. In Japanese; English summary p. 53.—The author examined the wave length of a stationary long wave over the Far East, and obtained the following formula:

$$L_s = 1.5U(A_s/\sin\varphi)^{\frac{1}{2}},$$

where L_s is the wave length of a stationary long wave in degree longitude, U the zonal wind velocity in deg. long./day, A_s the amplitude of the long wave in degree latitude, and φ the latitude. A nomogram for calculating the above expression is given. *Subject Headings:* **1. Long wave forecasting 2. Nomograms 3. Far East.**—*Author's abstract.*

11.3–223 551.509.59:621.396.11

Kuperov, L. P., **O metodike kratkosrochnogo radioprognozirovaniia.** [Method of short-term forecasting of radio conditions.] *Problemy Arktiki*, Leningrad, No. 2:141–147, **1957.** 3 figs., table, 3 refs. **DLC** (G600.P7). Transl. into English by E. R. Hope issued as *Canada. Defence Research Board, Translation* 287-R, April 1958. 4 p. 3 figs., etc. Available **DWB** (621.38411 K96me)—It was a part of the Second International Polar Year Program (1932/33) to observe the radiowave transmission in the short wave band at Tikhaia Bay, as well as the maximum and minimum frequency of signals that reach the reception point. Since then, observations of the like continued in 1945–1947 in the same area, in 1951–1952 at Dickson Island, and in 1955 at Tiksi Bay. It was concluded that reliable data on shortwave radio communication conditions can be obtained from such observations. A discussion and the analysis of this last study at Tiksi Bay is outlined together with a chart for the distribution of station frequencies heard from Africa, European U.S.S.R., the Indian Ocean, Japan, China, Indonesia, the Pacific Ocean, the Atlantic Ocean, Europe and America. *Subject Headings:* **1. Short wave radio transmission 2. Radio wave propagation forecasting. I. Hope, E. R.** (*transl.*).—*N.N.*

11.3–224 551.509.59:551.510.62:621.396.1

†U. S. Navy Weather Research Facility, **Some aids for estimating atmospheric refractive conditions.** Project AROWA, Interim Research Report on Task 31 (Meteorological aspects of refraction and propagation of radar waves), June **1958.** 52 p. 13 figs., 5 charts, 2 tables. Bibliog. p. 39–52. **DWB** (M93.1 U585so)—The U. S. Navy Weather Research Facility has been developing new techniques for predicting the atmospheric refractive index as a part of the meteorological aspects of refraction and propagation of radar waves. This report contains the results of their efforts. The report covers the refractive index formulas, the atmospheric effects on radar propagation, the needed computation aids, the atmospheric refractive data and 113 selected references on related atmospheric conditions. *Subject Headings:* **1. Refractive index forecasting 2. Radar propagation. I. Project AROWA (Task 31).**—*N.N.*

11.3–225 551.509.59:551.510.535:621.396

*Zacharisen, Donald H. (*Natl. Bureau of Standards*), **World maps of F2 critical frequencies and maximum usable frequency factors.** *U. S. National Bureau of Standards, Technical Note*, No. 2, April **1959.** 244 p. 7 figs. Almost entirely charts. "This work prepared in response to Study Program 60 and Recommendation 176 of the International Radio Consultative Committee (CCIR)." Price: $3.50 from U. S. Office of Technical Services, Wash., D. C. **DWB.** Also: Zacharisen, D. H. and Agy, Vaughn, **World maps of F_2 critical frequencies . . .** *Journal of Geophysical Research*, 65(2):593–595, Feb. **1960.** 3 refs. **DLC**—This report was prepared for the purpose of presenting six months of contour maps and charts for use in predicting F2-layer maximum usable frequencies. Prediction maps for each even hour of G.M.T. and charts in which time is continuous along the abscissa are given for the months of January, March, June, July, September and December. The four parameters used for predicting MUFs are *fo*F2 and the 4000 km MUF factor for a twelve-month running average Zurich sunspot number of 50, and the rates of change of *fo*F2 and 4000 km MUF factor with sunspot number. The first three parameters use a map presentation with G.M.T. constant over the surface of the map. The fourth parameter uses a chart presentation in which the ordinate is geomagnetic latitude and the abscissa is local time. The second article is a lengthy review of the original (*ed.*). *Subject Headings:* **1. F2 layer critical frequencies 2. F2 layer maximum usable frequency forecasting.**—*Author's abstract.*

WEATHER LORE

11.3–226 551.509.8

Howe, G. Melvyn (*Dept. of Geography, Univ. College of Wales, Aberystwyth*), **Welsh weather lore.** *Weather*, London, 13(9):298–302, Sept. **1958.** 4 refs. **DWB**—A number of Welsh weather proverbs for forecasting daily and seasonal weather are cited and the scientific validity of some of the sayings is discussed. Also weather sayings concerned with the behavior of

animals and plants and with agricultural yields are mentioned. **The Husbandman's Perpetua Prognostication,** published in 1794 by the weather prophet WILLIAM AUGUSTUS is citec *Subject Heading:* **1. Weather lore.**—*I.L.D.*

11.3–227 551.509.

Kletter, L. (*Vienna*). **Alte Bauerwetterregeln im Lichte der modernen Wissenschaft** [Old weather maxims in the light of modern science.] *Wetter und Leben*, Vienna, 10(1/2):12- 24, Jan. **1958.** fig., 12 refs. **DLC**—The various weather maxims prevalent in Europe ar classified into four categories, namely: rules based upon superstition, rules which contain weather prediction and by taking the weather of a given day to be indicative of the weathe of a subsequent period, correlation rules and singularity rules. The validity of the individua maxims is analyzed in terms of climatological data. The author concludes the prognosti value of these maxims is slight, but those rules which are based upon careful observation o nature are valuable. This is particularly true of singularities, in this case the agreement of the maxims with meteorological observations is surprisingly good. *Subject Headings:* **1. Weathe lore 2. Singularities.**—*I.L.D.*

11.3–228 551.509.8

Ranninger, Rudolf, **Pflanzen, Tiere und Wolken als Wetterpropheten!** [Plants, animals and clouds as weather prophets!] *Universum*, Vienna, 9(16):489–492, Aug. 2, **1954.** fig. **DLC**—From experience of his own and of others, the author mentions details in the behavior of animals and plants and in the appearance of clouds, which are indicative of forthcoming weather. *Subject Heading:* **1. Weather lore.**—*G.T.*

PART II. ANNOTATED BIBLIOGRAPHY ON NUMERICAL FORECASTING (SECOND SUPPLEMENT)

By: *Geza Thuronyi*

INTRODUCTORY NOTE

A bibliography on **Numerical Forecasting** was published in *Meteorological Abstracts and Bibliography*, 5(6):734–758, June **1954.** This was supplemented in *MAB*, 8(6):804–840, June **1957.** Since papers on numerical forecasting still occupy considerable space in meteorological literature, indicating continuing or increasing interest in the subject, it was decided to publish a second supplement. Together the three compilations contain some 500 items organized and indexed for the user's convenience. Allowing for some omissions, which are bound to occur in a collection of current material, it is hoped that workers in the field, or those about to engage in it, will find this a useful and reasonably complete guide to past and present world activities in numerical forecasting.

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11C–1 551.511.6:551.509.313

Adem, Julián (*Univ. Nacional de México, Inst. de Geofísica*), **On the relation between pressure and wind, with particular reference to a vortex.** *Tellus,* Stockholm, 10(3):326–330, Aug. **1958.** tables, 6 refs., 13 eqs. **DLC**—It is shown that if the boundary conditions to solve the vorticity and balance equations are prescribed independently, then the primitive equations of motion are not satisfied. Given the wind field of a symmetrical vortex embedded in a resting atmosphere, analytical expressions for the pressure and wind tendency are derived. A numerical example is worked out and the results are used to obtain information regarding the effect of the boundary conditions and of the variation of the Coriolis parameter in a forecast with a barotropic model. (*Same item as* 10.7–159, July 1959, *MAB.*) *Subject Headings:* **1. Vorticity equations 2. Balance equation 3. Numerical forecasting techniques.**—*Author's abstract.*

11C–2 551.509.313

Andreoletti, J., **Les modèles en météorologie dynamique.** [Models in dynamic meteorology.] *Journal Scientifique de la Météorologie,* Paris, 8(30):29–46, April/June **1956.** 3 figs., 7 refs., eqs. French, English and Spanish summaries p. 29. **DLC**—The basic equations of atmospheric motion and the simplified one-, two- and three-parameter models based thereon are reviewed, and their application to machine methods of calculation is discussed. The author believes that shortcomings of the simplified models can be largely eliminated by introducing empirical adjustments. The efficiency of the models could be further improved by using more complicated models; this is subject to limitations by the speed of the computer and the storage capacity of its memory. *Subject Heading:* **1. Numerical forecasting.**—*G.T.*

11C–3 551.509.313:681.14:621.38(04)

American Meteorological Society. District of Columbia Branch, **Proceedings of the Workshop on Numerical Weather Prediction, George Washington Univ., Wash., D. C., June 2–4, 1954.** 103 p. figs., refs., eqs. Mimeog. from recordings made at the lectures. Copies obtainable from American Meteorological Society, 45 Beacon Street, Boston 8, Mass. **DWB**—A transcript of recordings made of a lecture series given by specialists in numerical forecasting. One lecture deals with the general theoretical basis and historical aspects, two with barotropic and baroclinic models, three with numerical methods and high speed computing machines, one with the prediction of precipitation and another with the possibilities of future applications. (For abstracts on individual articles *see* 7.6–92, 7.6–93, 7.7–115, 8.3–122, 8F–25, 8F–26, 8F–122 and 11C–186, *MAB.*) *Subject Headings:* **1. Numerical forecasting techniques 2. Electronic computers.**—*A.A.*

11C–4 551.509.312/3:551.510.53

Arnason, Geirmundur, (*Joint Num. Weather Prediction Unit, Suitland, Md.*), **Some considerations for numerical prediction in the stratosphere with results of 24-hour barotropic forecasts for 100 millibars.** (In: American Meteorological Society. District of Columbia Branch, **Proceedings of the Workshop on Stratospheric Analysis and Forecasting, Feb. 1–3, 1956.** pub. **1956.** p. 156–164. 3 figs., table, 3 refs., 8 eqs.) **DWB**—Since variations in static stability are considerably smaller in the stratosphere than in the troposphere and since horizontal divergence is related closely to time and space variation in the static stability in such a way that small variations correspond to small divergence, barotropic forecasts are particularly applicable for the stratosphere. The preparation of 100 mb barotropic forecasts is described and the results of such forecasts are summarized and presented in a table. "The mean correlation coefficients as well as the mean ∂_E's are practically the same for two series of thirty-four 100 mb forecasts and sixty 500 mb forecasts." The observed 24-hr changes at 100 mb were on the average $\frac{2}{3}$ of those at 500 mb. There did not appear to be any systematic difference between observed (∂_0) and predicted (∂_E) at 100 mb. An appendix contains a theoretical, mathematical analysis of the gross features of the vertical distribution of the horizontal

velocity divergence. *Subject Headings:* **1. Barotropic stratospheric forecasts 2. Numerical forecasting 3. Static stability.**—*I.L.D.*

11C–5 551.511.32:551.509.313

Arnason, G., **A convergent method for solving the balance equation.** *Journal of Meteorology*, Boston, 15(2):220–225, April **1958.** fig., 8 refs., 17 eqs. **DWB, DLC**—(For abstract, *see* 10.3–1655, March 1959; for abstract from different source, 8F-5, June 1957, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Balance equation.**

11C–6 551.511.6:551.509.313

Arnason, G. and Carstensen, L. P. (*JNWPU, Suitland, Md.*), **The effects of vertical vorticity advection and turning of the vortex tubes in hemispheric forecasts with a two-level model.** *Monthly Weather Review*, 87(4):119–127, April **1959.** 6 figs., 3 refs., 18 eqs. **DWB**—A 2-parameter forecasting model which includes the effects of vertical vorticity advection and turning of the vortex tubes is briefly described. Contributions of the above-mentioned terms are discussed and an example is presented. The importance of consistent truncation over a large grid is pointed out. *Subject Headings:* **1. Numerical models 2. Vertical vorticity advection.**—*Authors' abstract.*

11C–7 551.509.313:681.4:621.38(47)

Arnason, G. (*Project Nanwep, U. S. Fleet Weather Central, Wash., D. C.*), **Numerical weather prediction in the U.S.S.R.,** Presented at the 175th National Meeting of the American Meteorological Society, March 24–27, **1959,** at Chicago, Ill. [1959]. 13 p. Mimeo. **DWB** (M09.312 A113nu)—The author has reviewed much of the Russian literature in the field of numerical prediction of weather beginning with KIBEL' in 1940 and BLINOVA in 1943, and subsequent developments during the 1945–55 period in the official short-range and extended range numerical forecasting programs in the U.S.S.R. compared with those in the U. S. BLINOVA's model seems to be that which was in general use until recently. Actual barotropic forecasts were made by 1950 but the developments and availability of electronic computers lagged somewhat over the theoretical developments. Four models of electronic weather computers are mentioned: "Pogoda," "Strela," BESM-I and BESM-II. Conclusion is that the U. S. was ahead of the U.S.S.R. in computer technology but theoretical superiority could enable the U.S.S.R. to surpass us in the near future. *Subject Headings:* **1. Numerical forecasting techniques in U.S.S.R. 2. Electronic computers in U.S.S.R. 3. U.S.S.R.**—*M.R.*

11C–8 551.509.313:551.511.33

Aubert, Eugene J. (*A. F. Cambridge Res. Center*), **On the release of latent heat as a factor in large scale atmospheric motions.** *Journal of Meteorology*, Boston, 14(6):527–542, Dec. **1957.** 13+ figs., table, 5 refs.—A mathematical formulation is made of a quasi-geostrophic numerical weather prediction model which includes the heat released during the condensation process. One set of 12- and 24-hr predictions is presented and discussed. Included are predictions made with and without the release of latent heat. While predictions were made at six pressure surfaces, figures only include height of the 1000-, 500-, and 200-mb surfaces, the vertical motion at the 800-, 400-, and 200-mb surfaces, and precipitation during 6- and 24-hr periods. The forecasts are compared with the observed distributions and the differences in the forecast patterns due to the release of latent heat are discussed. It is concluded that the release of latent heat causes significant differences in the cyclone-scale pressure, vertical motion, and precipitation distributions during forecasts of one day. (*Same item as* 10.2–149, Feb. 1959, *MAB.*) *Subject Headings:* **1. Large scale weather processes 2. Latent heat release 3. Numerical forecasting.**—*Author's abstract.*

11C–9 551.509.313:551.511.33:517.91

Baev, V. K., **Integral'nye uravneniia pogody.** [Integral equations of weather.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 64:26–60, **1958.** 3 refs., numerous eqs. **DLC**—The author derives the integral weather equations in such a way that it is possible to compute the wind, pressure, temperature and vertical current fields from the initial data. The contents of this mathematical paper comprise the following: the initial system of differential equations of thermodynamics in the form of equation of motion, of continuity, of heat advection and of state; deviation of an expression of a tensor of velocity of displacement, π, and of integral differential equations of the components of the displacement tensor; solution of the equation for determining π for a partial field; and derivation and solution of the equation for determining air temperature, temperature of the earth, density, etc. *Subject Headings:* **1. Numerical forecasting 2. Weather analysis.**—*I.L.D.*

11C–10 551.509.313:551.552

Barnes, Stanley L., **A numerical technique for predicting wind fields using a Lagrangian approach.** Texas. Agricultural and Mechanical College. Dept. of Oceanography and Meteorology, Contract AF 19(604)-2222, Scientific Report No. 5, Oct. **1958.** 18 p. 2 figs., 3 tables, 2 refs., 10 eqs.

WB (M(051) T355sci)—A numerical technique for predicting the wind field using a Lagrangian pproach is presented. Two equations are used which determine Lagrangian accelerations in terms the fields of velocity and geopotential. The first is based on the simplified equations of horizontal, ictionless motion of a particle; the second is based on a variational principle as applied to the otion of a closed system. These equations are used separately to obtain the individual change in elocity of a parcel. By use of the analytical expansion of the individual change, the local change in elocity is obtained. Using this technique, the equations are solved by finite difference approxima- ons for an array of grid points. The method is tested for three case studies. Based on normally vailable data, twelve-hour forecast velocities at the 500 mb surface are obtained by a "marching" rocess. Results indicate consistent errors are being made in both direction and magnitude of recast winds. Whether these errors are caused by certain assumptions in the theory or by the chnique used has not yet been determined. A large percentage of error is found to be introduced rough subjective analyses of the data. Suggestions for further study into the theoretical and chnical aspects of the problem are given. *Subject Headings:* **1. Numerical wind forecasting Wind field calculation.**—*Author's abstract.*

11C–11 551.509.1:551.509.312

Bedient, H. A. and Cressman, G. P. (*both, Joint Numerical Wea. Pred. Unit, Suitland, Md.*), **n experiment in automatic data processing.** *Monthly Weather Review*, Wash., D. C., 85(10):333–40, Oct. **1957.** 3 figs., 2 tables, 9 refs. **DWB, DLC**—An experiment in the automatic preparation f input data for use in numerical prediction is described. The process includes the automatic ecognition, identification, and decoding of the raw teletypewriter data up to the point where they re ready for use in objective analysis. The problems encountered and the methods used to attack hese are described. Present methods of coding and communication are such as to impede progress n automatic processing of meteorological data. Suggestions are made for improved coding methods s well as for improvements in the methods of automatic processing used to date. (*Same item as* .8–127, Aug. 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting techniques 2. Automatic ata processing.**—*Authors' abstract.*

11C–12 551.509.312:551.509.322:681.1

Belousov, S. L., **Kratkosrochnyĭ prognoz davleniia s pomoshch'iu bystrodeĭstvuiushchikh aashin.** [Short-range forecasting of pressure by means of high-speed computers.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 60:10–16, **1957.** 3 figs., 4 refs., 6 eqs. **DWB** (M(055) U581ts)—A method is presented for forecasting pressure based upon the solution of the system of quations

$$\Delta\frac{\partial\varphi}{\partial t}-l^2\frac{\partial\tau}{\partial p}=-\frac{1}{l}(\varphi,\Delta\varphi)-\beta\frac{\partial\varphi}{\partial x};\qquad \frac{\partial^2\varphi}{\partial p\partial t}+\frac{c^2}{p^2}\tau=\frac{1}{l}\left(\frac{\partial\varphi_1}{\partial p_1}\varphi\right)$$

y means of high speed calculating machines. Also, the results of some computations obtained in he Central Institute of Forecasting in 1954–55 are presented. In the above equations the independ- nt variables are time (t), the coordinates x, y and the pressure (p); the geopotential φ and vertical elocity τ are expressed in the given isobaric system of coordinates. The first stage in this solution nvolves forecasting geopotential heights at the mean level of the atmosphere, that is when $\partial\tau/\partial p=0$. f φ is considered the geopotential of this isobaric surface ($p=700$ mb, then

$$\Delta\frac{\partial\varphi}{\partial t}=-\frac{1}{l}(\varphi,\Delta\varphi)-\beta\frac{\partial\varphi}{\partial x}.$$

By solving this equation as a Poisson equation relative to function $\partial\varphi/\partial t$ this function can be de- ermined at various points of the region investigated. The numerical computation of this problem s outlined and the computed results are presented and shown to be correct. *Subject Headings:* **1. Short range pressure forecasting 2. High speed computers.**—*I.L.D.*

11C–13 551.509.312:551.542:551.43

Belousov, S. L. and Bykov, V. V., **Ob uchete vliianiia gor pri prognoze baricheskogo polia.** [Consideration of the effect of mountains in forecasting the baric field.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz.*, 9:1142–1153, **1957.** 11 figs. (incl. fold. maps), 3 refs., 11 eqs. **DWB**—One of the possibilities of increasing the precision and effectiveness of forecasting for the mean level of the atmosphere by means of electronic calculators is to take into account vertical atmospheric motions, especially those produced by large mountain chains. The equation for forecasting the geopotential at mean atmospheric levels is derived, namely:

$$\Delta q-\frac{\partial\ln\eta}{\partial x}\frac{\partial q}{\partial x}-\frac{\partial\ln\eta}{\partial y}\frac{\partial q}{\partial y}=\bar{F}(x,y,\eta),$$

where

$$\tilde{F}(x,y,\eta) = -\frac{g}{l}\left(\tilde{H}, \frac{1}{\eta}\Delta\tilde{H} - \frac{1}{\eta^2}\frac{\partial\eta}{\partial x}\frac{\partial\tilde{H}}{\partial x} - \frac{1}{\eta^2}\frac{\partial\eta}{\partial y}\frac{\partial\tilde{H}}{\partial y}\right) - \beta\frac{\partial\tilde{H}}{\partial x} - \frac{l}{n}(\eta,\tilde{H}),$$

$$q = \frac{\partial\tilde{H}}{\partial t}.$$

The solution of this equation for a universal electronic computer is presented and its applicati to calculating the effect of the Scandinavian mountains and to 24-hr forecasting of high altitu charts is illustrated. (*Same item as* 10.2–147, Feb. 1959, *MAB.*) *Subject Headings:* **1. Orograph effects on forecasting 2. Forecasting by barometric tendencies 3. Electronic computers.**—*I.L.*

11C–14 551.509.39:551.547

Belousov, S. L., **O predvychislenii davleniia na raznykh urovniakh atmosfery.** [The forecasti of pressure at various levels in the atmosphere.] *Meteorologiia i Gidrologiia*, Leningrad, 9:15–1 **1957.** 3 figs., 3 refs., 4 eqs. **DWB, DLC.** Transl. into English by A. Nurklik issued as *Canad Meteorological Branch, Meteorological Transactions*, No. 1:1–6, Jan. 1959.—The author solves t problem of forecasting pressure at different levels without assuming a polytropic atmosphere. T formula for determining the distribution of the geopotential at four levels for any given moment

$$\frac{\partial H}{\partial t} = (0,0,t;\zeta) = \sum_{i=1}^{4}\int_0^{2\pi}\int_0^{\alpha} G_\varphi'(\zeta,\zeta_i,r)A_\Omega(\zeta_i,r,\varphi)r\,dr\,d\varphi + \sum_{i=1}^{4}\int_0^{2\pi}\int_0^{\infty} G_T'(\zeta,\zeta_1,r)A_T(\zeta_1,r,\varphi)r\,dr\,d\varphi.$$

By means of the formula

$$H_{t=\tau} = H_{t=0} + \left(\frac{\partial H}{\partial t}\right)_{t=0}\tau,$$

the distribution of pressure was computed with an electronic computer. Charts showing pressu distribution are presented. *Subject Headings:* **1. Pressure forecasting 2. Pressure distributio** —*I.L.D.*

11C–15 551.509.313:061

Belousov, S. L., **Mezhdunarodnaia konferentsiia po chislennym metodam prognoza.** [Inte national Conference on Numerical Forecasting.] *Meteorologiia i Gidrologiia*, Leningrad, 9:58–5 **1957. DWB, DLC.** English trans. by Valyz Zilius issued by American Meteorological Societ under Contract AF 19(604)-1936, Sept. **1958.** (4 script p.)—A report of the International Confe ence on Numerical Forecasting that was held in Stockholm in June 1957. The papers presented a the conference included the following: development of the hydrodynamic method of forecasting i the U.S.S.R. (E. N. Blinova and I. A. Kibel' *see also* 11C–26); the use of the Green function i solving the problem of short range forecasting by means of electronic computers (Belousov) numerical forecasting in the U. S. in the Joint Numerical Weather Prediction Unit (G. Arnason) investigation of the errors of numerical solution of forecast equations solved by electronic computers graphical methods of forecasting; solution of the "equation of balance" establishing a more exac relationship between the gradient pressure and wave velocity; forecasting pressure change nea frontal zones by using a double layer model with potential temperature as vertical coordinates; lon range forecasting by hydrodynamic methods; practical rain forecasting (Smagorinsky), etc. (*Sam item as* 10.8–68, Aug. 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting conference 2. Short range forecasting 3. Long range forecasting.**—*I.L.D.*

11C–16 551.511.6:551.509.31

Belousov, S. L., **O predvychislenii davleniia v sredneĭ troposfere dlia Severnogo polushariia** [Numerical prediction of pressure in the middle troposphere for the Northern Hemisphere.] *Me teorologiia i Gidrologiia*, Leningrad, No. 11:3–10, **1958.** 4 figs., 2 refs., 13 eqs. **DWB, DLC**—Th author presents the formulae developed by E. N. Blinova for predicting pressure in the middl troposphere of the Northern Hemisphere. The initial equation is that of vorticity transfer at th mean level of the atmosphere:

$$\Delta\frac{\partial\psi}{\partial t} + \frac{1}{a^2\sin\theta}(\psi,\Delta\psi) + 2\omega\frac{\partial\psi}{\partial\lambda} = 0.$$

In relation to $\partial\psi/\partial t$ this equation becomes the Poisson equation on a sphere and its solution at any point θ, λ, has the form

$$\frac{\partial\psi}{\partial t}(\theta,\lambda) = \frac{1}{2\pi}\int_0^{2\pi}\int_0^{2\pi}\left[\frac{1}{a^2\sin\theta}(\Delta\psi,\psi) - 2\omega\frac{\partial\psi}{\partial\lambda}\right]G(\theta,\theta',\lambda-\lambda')\sin\theta'\,d\theta'\,d\lambda'.$$

quations for computing the terms of this equation, the practical application of these formulas and sults obtained are presented. *Subject Headings:* **1. Numerical pressure forecasting 2. Poisson's uations.**—*I.L.D.*

11C–17 551.509.313:551.511.6

Benton, George S. (*Johns Hopkins Univ., Balto., Md.*), **Some comments on the numerical tegration of the vorticity equation and related equations.** *Tellus*, Stockholm, 10(3):313–325, Aug. **58.** 5 figs., 2 tables, 3 refs., 23 eqs. **DLC**—It is shown that if the stream function is specified er an Eulerian region $R(x,y)$ at $t=0$, and on the boundaries of $R(x,y)$ at $t>0$, a solution of the rticity equation which satisfies certain conditions of continuity will be unique. If vorticity is also ecified at the inflow boundary, such a solution is excluded. In the latter case, an internal dis-ntinuity propagates into the region along a material surface, and in principle solutions should be btained separately for each sub-region and "matched" kinematically and dynamically at the terface. The associated analytical or numerical problems are prohibitive. The problem of btaining stable methods of numerical integration, specifying only the stream function on the undary, is considered. Numerical integrations of a nonlinear first order differential equation dicate that such stable methods may exist, in contradiction to linear theory. The integration of e vorticity and associated equations for the first time-step is also considered. A method is pre-nted which is not only simple to apply, but also maintains the same accuracy as succeeding time-eps for which centered difference techniques are used. (*Same item as* 10.7–160, July 1959, *MAB.*) *ubject Headings:* **1. Vorticity equations 2. Integration techniques 3. Numerical forecasting tech-ques.**—*Author's abstract.*

11C–18 551.509.5:551.509.313:551.509.317

Berggren, Roy (*Swedish Met. & Hydrological Inst., Stockholm*), **On the accuracy of 500 mb and 0 mb analysis with special reference to numerical forecasting.** Uppsala, Almquist & Wiksells, 958. 8 p. Thesis (Ph.D.) Uppsala Univ. **DWB** (M09.317 B496on)—A summary of four papers ublished in *Tellus*, *Geophysica* and *Arkiv f. Geofysik.* (See the next four items.) *Subject Headings:* **Numerical forecasting errors 2. Barotropic models 3. Upper air analysis 4. Forecast erification.**

11C–19 551.509.5:551.509.313:551.509.317

Berggren, R., **On the accuracy of 500 mb analysis with special reference to numerical forecasting.** *ellus*, Stockholm, 9(3):323–340, Aug. **1957.** 7 figs., 6 tables, 16 refs. **DWB, DLC**—The result f an analysis experiment is discussed. From 29 different analyses of one and the same 500 mb chart ertain parameters were calculated. The standard deviations of the height of the 500 mb surface ad an average value of 15 gdm, determined over an area of 4200×8100 km. The correlation oefficient between the observed changes forecast with a numerical barotropic forecast varied between .53 and 0.77 (24 h), 0.77 and 0.84 (48 h), respectively. Some other verification parameters are iven. Calculations of the geostrophic wind are carried through for all analyses, at points, over reas and along certain tracks. The deviations due to the differences in analysis are sometimes onsidered. (*Same item as* 9.9–131, Sept. 1958, *MAB.*) *Subject Headings:* **1. Upper air analysis . Barotropic models 3. Numerical forecasting errors 4. Forecast verification.**—*Author's abstract.*

11C–20 551.509.5:551.509.313:551.509.317

Berggren, R., **Comparative studies of 500 mb barotropic forecasts based on different analyses.** *ellus*, Stockholm, 10(3):289–298, Aug. **1958.** 3 figs., 7 tables, 11 refs., 5 eqs. **DLC**—Some baro-ropic 500 mb forecasts are compared in the following ways: 1) comparison of the differences between orecasts made from analyses with identical boundary regions but different inner parts; 2) comparison f forecasts made from two independent analyses based on identical material; and 3) comparison etween forecasts based on two analyses with identical inner region but different boundary regions. he result of a computation of the standard deviation of the vorticity and the Jacobian J (n,ϕ) is iven and discussed, the deviation being due entirely to the personal factor in upper air analysis. (*Same item as* 10.7–161, July 1959, *MAB.*) *Subject Headings:* **1. Barotropic models 2. Numerical orecasting errors 3. Upper air analysis 4. Forecast verification.**—*Author's abstract.*

11C–21 551.509.5:551.509.313:551.509.317

Berggren, R., **A comparative study of 700, 500 and 300 mb barotropic forecasts.** *Geophysica*, Helsinki, 6(3/4):147–167, **1958.** 3 figs., 4 tables, 13 refs. **DWB, DLC**—A comparison is made be-ween 700, 500 and 300 mb barotropic forecasts. Error charts as well as tables with different veri-ication parameters are used. A discussion is also given of the effect of differences between base nalyses. The distribution of absolute geostrophic vorticity is discussed. By an example it is hown that differences between analyses may give rise to quite different results when computing ertical velocities with the aid of the vorticity equation. *Subject Headings:* **1. Numerical forecasting rrors 2. Upper air analysis 3. Forecast verification.**—*Author's abstract.*

11C–22 551.509.5:551.509.3

Berggren, R., **Further studies on the accuracy of upper air analysis.** *Arkiv för Geofysik*, Stoo holm, 3(2):41–51, **1959.** 2 figs., 3 tables, 4 refs. **DLC**—The necessity for improved, more unifo procedures in upper air analysis is well illustrated by the experiment discussed. A representati number of the 26 Swedish analysts came up with different results of the identical analysis of a 500 r chart for 0300 GMT, Nov. 7, 1949 and a 300 mb chart for 0300 GMT, Nov. 4, 1956 which were ar lysed and then repeated the following year. The analysts had free choice between direct analysis a the different analysis techniques. With all these analyses on hand, the author computed the roo mean-square of the differences between the conventional and the numerical analysis techniques f all combinations of the chart. The results are presented and discussed. *Subject Headings:* **1. Upp air analysis 2. Forecast verification.**—*W.N.*

11C–23 551.511.3:551.509.3

Berkofsky, Louis, (*U. S. Air Force Cambridge Res. Center, ARDC, Boston.*) **Some estimates nongeostrophic effects calculated from a vertically integrated nongeostrophic model.** *Germa Deutscher Wetterdienst, Berichte*, 5(38):6–13, **1957.** 3 figs., 8 refs., 63 eqs. English and Germa summaries p. 6. **DWB, DLC**—The use of nongeostrophic models in numerical forecasting has t advantage that nongeostrophic effects may be included and that the equations remain valid at lo levels. Since the solution given by vertically integrated equations may be approximated to an other desired level, a nongeostrophic baroclinic vertically integrated model needs to be formulate The two dimensional mean flow (vertically integrated) equations are obtained by integrating th appropriate equations with respect to pressure throughout the depth of the atmosphere and the introducing modelling approximations, which "represent constraints on the vertical structure of th fluid such that parameters may be made to depend upon parameters at a specific level." The form lation of such modelling approximations in the nongeostrophic case is illustrated by an example which the horizontal wind vector is represented as the sum of an irrotational and a nondiverge vector. The physical model considered in comparing results obtained from a geostrophic with nongeostrophic model, is the thermotropic model which is a vertically integrated quasi-geostroph model. The deviation of nongeostrophic flow equations directly comparable to quasi-geostroph equations is presented. The effects of nongeostrophic flow conditions are studied by considerin one dimensional nonlinear flow. There are presented examples of numerical computations fro which were obtained rough estimates of the height tendencies for various degrees of departure of th initial conditions from geostrophic conditions, all corresponding to the same initial stream fiel (*Same item as* 10.8–209, Aug. 1959, *MAB.*) *Subject Headings:* **1. Nongeostrophic models 2. No geostrophic wind approximation 3. Numerical forecasting.**—*I.L.D.*

11C–24 551.509.52:551.509.313:551.515.2

Birchfield, Gene E., **Numerical prediction of hurricane movement with the use of a fine gri** Chicago Univ. Dept. of Meteorology, Contract Cwb 9016, Technical Report No. 4, March **195** 14 p. 9 figs., table, 8 refs. **DWB** (M15.2 C532te)—A numerical model is described for integratin the barotropic prediction equations to obtain forecasts of the displacement of a hurricane cente The model employs a fine grid which is centered over the hurricane and covers only the vorte circulation. Forecasts for "Connie" and "Diane" (1955) are presented. Although these gradient wind forecasts do not show any significant improvement over the geostrophic forecasts, it is believe that the use of a stream function for the total wind field should make an improvement in the pre dictions, particularly on relatively small-scale disturbances. (*Same item as* 9.11–141, Nov. 195 *MAB.*) *Subject Headings:* **1. Hurricane movement forecasting 2. Numerical hurricane forecasting** —*Author's abstract.*

11C–25 551.509.313:551.54:681.14:621.3

Birkgan, A. Iu. and Liubimov, A. N., **Predvychislenie karty AT-700 na elektronnoi tsifrov mashine "Strela."** [Numerical forecasting of the AT-700 map with the electronic computin machine "Strela" (arrow).] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz.*, 1:93–99, **1958.** 3 figs. 2 refs., 11 eqs. **DLC.** Transl. into English available Special Libraries Association Translatio Center (John Crerar Library, Chicago) as its R-3505.—The equations developed by S. L. Belousov for numerical computation of pressure at mean level of the atmosphere for use with the BESM computer are employed to make a 24 hr numerical forecast of the 700 mb chart with the "Strela" electronic computer. The authors present the procedure for programming and solution of problem on the "Strela" computer, including arithmetical operations on numbers and commands, functiona operations and standard subprogramming. The procedure and organization for the numerica forecast of the 700 mb chart are described. An appendix contains tables of the actual commands operators and procedures, and distribution of memory. *Subject Headings:* **1. Numerical forecastin 2. Electronic computers 3. Prognostic chart preparation.**—*I.L.D.*

11C–26 551.509.313:551.509.33

§Blinova, E. N. and Kibel', I. A. (*both, Central Forecasting Inst., Moscow*), **Hydrodynamical methods of the short- and long-range weather forecasting in the USSR.** *Tellus*, Stockholm, 9(4): 447–463, Nov. **1957.** 9 figs., 24 eqs. **DWB**—The Kibel' model of short range numerical forecasting, used with some variations in the U.S.S.R. for the past 15 yrs, is given (by KIBEL') in some detail, and graphical methods derived therefrom described. Linearization methods for mid-tropospheric short range forecasting (KIBEL', 1950; MARCHUK, 1954 and NEMCHINOV, 1955) are similar to long range forecasting methods described in the second part of the paper. Use of computing machines for solving the nonlinear problem, with one, two and four level models, and for orographic frontal and nongeostrophic complications, is expounded. The various long range problems and their partial solution by machine and graphical techniques are described and illustrated in the second part (by E. N. BLINOVA). They involve 500 and 700 mb N. Hemisphere prognostic charts for several days or weeks. (*Same item as* 10.2–150, Feb. 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting techniques 2. Long range forecasting techniques 3. Kibel's method of forecasting.**—*M.R.*

11C–27 551.509.313(02)

†Brandejs, Stanislav (*Met. Dept., Charles Univ., Prague*), **Úvod do početní předpovědi počasí.** [Introduction to numerical weather forecasting.] *Geofysikální Sborník*, Prague, No. 61, **1957.** 156 p. 23 figs., 23 tables, refs., numerous eqs. German and Russian summaries p. 153–156. **DLC**—This highly technical text is designed to thoroughly familiarize students or synoptic meteorologists with the theory and techniques of numerical forecasting. The study is divided into two parts, the first dealing with the quasi-static equations of atmospheric dynamics, with pressure as an independent variable (hydrostatic equation; thermodynamic changes in time and space; geostrophic wind, divergence and vorticity; ageostrophic wind component; gradient wind and its divergence; continuity equation; vorticity equation; pressure tendency equations, etc.). The second part takes up the prognostic equations of various atmospheric models (barotropic, advective and baroclinic), their numerical and graphical integration, and their verification. The work incorporates the latest progress reported in international literature (with extensive references to the sources used), including full mathematical treatments of the methods described. As one of the first textbooks devoted entirely to numerical forecasting, this book may be considered the most direct way available to a clear understanding and mastering of this field, once the language difficulty is overcome. (*Same item as* 10.3–3, March 1959, *MAB.*) *Subject Heading:* **1. Numerical forecasting textbooks.**—*G.T.*

11C–28 551.509.313

Brandejs, S. and Vítek, Vojtěch, **Prognostic equations of baroclinic model with constant direction of wind shear.** *Studia Geophysica et Geodaetica*, Prague, 1(1):141–156, **1957.** 6 refs., 31 eqs. Russian summary p. 155–156. **DWB**—The geostrophic and ageostrophic versions of the Sawyer-Bushby (1953) baroclinic model are analyzed. An extension of the model is derived, in which height variations of the level of nondivergence, and orographic effects are taken into account. *Subject Headings:* **1. Sawyer-Bushby model 2. Numerical forecasting techniques.**—*G.T.*

11C–29 551.509.313:551.543.5

Brandejs, S., **Remarks on the mechanism of surface-pressure changes in baroclinic atmosphere.** *Studia Geophysica et Geodaetica*, Prague, 1(2):387–390, **1957.** 4 refs., 9 eqs. Russian summary p. 390. **DWB**—An equation is developed for calculating surface pressure changes with a baroclinic model of the atmosphere assuming constant thermal wind direction and several simplifying conditions. Each term of the equation is discussed briefly. *Subject Headings:* **1. Baroclinic models 2. Numerical pressure forecasting.**—*Transl. of author's abstract.*

11C–30 551.509.313:551.542

Brandejs, S. and Zikmunda, O., **Rovnice pro předpověď přízemního tlakového pole.** [Equations for predicting the surface pressure field.] *Meteorologické Zprávy*, 10(3):60–63, **1957.** 2 refs., 36 eqs. Czech, Russian and German summaries p. 60. **DWB.** Transl. into English available for reference. **DWB** (M4 B817eq)—For a baroclinic atmosphere with constant thermal wind direction, a system of prognostic equations is derived, which is suitable for numerical forecasting of the surface pressure field and for the 1000–500 mb relative topography. Both geostrophic approximation and HINKELMANN'S extension are used in the equations, and fixed as well as variable level of nondivergence is accounted for. (*Same item as* 10.10–175, Oct. 1959, *MAB.*) *Subject Headings:* **1. Surface pressure field 2. Numerical pressure forecasting.**—*Authors' abstract.*

11C–31 551.509.313:551.509.329:551.547.5

Brandejs, S. and Zikmunda, O., **Über die numerische und graphische Vorhersage des Bodendruckfeldes.** [Numerical and graphical prediction of surface pressure fields.] *Zeitschrift für Meteorologie*, Berlin, 11(10/11):305–311, Oct./Nov. **1957.** 9 refs., 32 eqs. **DWB, DLC**—The

authors develop prognostic equations of a baroclinic field with a moving divergence-free level and with a fixed divergence-free level. (For a fuller abstract, *see* 10.7–162, July 1959, *MAB.*) *Subject Headings:* **1. Numerical pressure forecasting 2. Pressure forecasting.**

11C–32 551.509.312:551.511:551.513.11

Brandejs, S.; Kopáček, Jaroslav; Věková, Nina and Zikmunda, Otakar (*all, Met. Inst., Charles Univ., Prague*), **Zur Anwendung der Fjørtoftschen Methode bei der Vorhersage von Höhenwetterkarten.** [Application of Fjørtoft's method in forecasting upper weather charts.] *Germany., Deutscher Wetterdienst, Berichte,* 5(38):14–18, **1957.** 5 figs., 3 tables, 3 refs. **DWB, DLC**—In the Institute of Meteorology of Charles University (Prague), thirteen 12-hr forecasts of absolute topography of the 50 mb surface and a like number of analogous 24-hr forecasts were computed with the aid of the Fjørtoft method. The average correlation coefficient of the 12-hr forecasts was 0.60 and of the 24-hr forecasts 0.50. The correlation for the numerically computed fields was better than that of the graphically computed. (For a fuller abstract, *see* 10.7–163, July 1959, *MAB.*) *Subject Headings:* **1. Fjørtoft's graphical method 2. Numerical forecasting.**

11C–33 551.509.313:551.547.5

Brandejs, S., **Formeln für die Berechnung der Stromfunktion im divergenzfreien Falle.** [Formula for the calculation of the stream function in nondivergent flow.] *Studia Geophysica et Geodaetica,* Prague, 2(4):402–405, **1958.** 5 refs., 24 eqs. Russian summary, p. 405. **DWB**—The numerical forecast of the absolute topography of the isobaric 500 mb surface computed by the barotropic equation with the aid of the geostrophic approximation usually is accompanied by considerable errors. The so-called false anticyclogenesis, which arises as a result of a consideration of the absence of divergence of flow in the equivalent barotropic level produces a systematic error. This false anticyclogenesis can be eliminated if the forecast of the 500 mb surface is made either by

$$\nabla_P{}^2 \frac{\partial \overline{\psi}}{\partial t} = J_P[k\nabla_P{}^2\overline{\psi} + \lambda, \overline{\psi}]$$

or by

$$\nabla_P{}^2 \frac{\partial \overline{\psi}'}{\partial t} = J_P[g\lambda^{-1}\nabla_P{}^2\overline{\psi}' + \lambda, \overline{\psi}']$$

in which the stream function $\overline{\psi}$ is defined by

$$\nabla_P{}^2\overline{\psi} = \lambda^{-1}\nabla_P{}^2\overline{\phi}, \qquad \nabla_P{}^2\overline{\psi} = \lambda^{-1}\nabla_P\overline{\phi} - \lambda^{-2}\nabla_P\overline{\phi}\cdot\nabla_P\lambda$$

and

$$\nabla_P{}^2\overline{\psi} - 2k\lambda^{-1}\left[\left(\frac{\partial^2\overline{\psi}}{\partial x\partial y}\right)^2 - \frac{\partial^2\overline{\psi}}{\partial x^2}\frac{\partial^2\overline{\psi}}{\partial y^2}\right] + \lambda^{-1}\nabla_P\overline{\psi}\cdot\nabla_P\lambda = \lambda^{-1}\nabla_P{}^2\overline{\phi}$$

or

$$\nabla_P{}^2\overline{\psi}' - 2g\lambda^{-2}\left[\left(\frac{\partial^2\overline{\psi}'}{\partial x\partial y}\right)^2 - \frac{\partial^2\overline{\psi}}{\partial x^2}\frac{\nabla^2\overline{\psi}'}{\partial y^2}\right] - \nabla_P{}^2\overline{Z} = 0.$$

Subject Heading: **1. Nondivergent flow.**—*I.L.D.*

11C–34 551.509.313

Brandejs, S., **Balanční rovnice a její použití při početní předpovědi barických polí.** [The balance equation and its application to numerical forecasting of the pressure field.] *Meteorologické Zprávy,* Prague, 11(3):66–70, **1958.** table, 13 refs., 30 eqs. Russian summary p. 66. **DWB**—It is known from the literature that in barotropic forecasting the geostrophic approximation to atmospheric circulation is subject to some errors. The geostrophic approximation is now usually being replaced by the so-called balance equation which is derived from the divergence equation according to certain simplifications. In the present article the different methods of solving the balance equation are reviewed in detail. *Subject Headings:* **1. Balance equation 2. Numerical pressure forecasting.**—*Transl. of author's abstract.*

11C–35 551.509.313:551.511:551.513.1

Bring, A. and Charasch, Eliahu, **An experiment in numerical prediction with two non-geostrophic barotropic models.** *Tellus,* Stockholm, 10(1):88–94, Feb. **1958.** 2 figs., table, 6 refs., 32 eqs. **DWB, DLC**—The result of a test with two simple nongeostrophic barotropic models is discussed. One of these models is based on ideas presented in a previous article (Charasch, 1957). The forecasts obtained are found to differ significantly from forecasts obtained with the quasigeostrophic model. Both nongeostrophic models appear to be free from one major weakness of the nongeostrophic model, i.e., the hypertrophy of anticyclones. It is suggested that the disappointing forecast-

g performance of baroclinic models hitherto to a considerable degree springs from a similar weakness as exposed here in the quasi-geostrophic barotropic model. (*Same item as* 10.3–166, March 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting techniques 2. Barotropic models.**—*Authors' abstract.*

11C–36 551.509.313:551.513:551.55

Bristor, Charles L., **Zonal wind errors in the barotropic model.** *Monthly Weather Review*, Wash., D. C., 87(2):57–63, Feb. **1959.** 7 figs., table, 6 refs., 4 eqs. **DWB, DLC**—Zonal wind errors in a series of numerical barotropic forecasts are discussed. A characteristic error is the growth of west winds in middle latitudes and their decay to the south. Momentum transport in the absence of momentum sources and sinks in the barotropic model is suggested as the principal contributor to this type of error. Evidence of nonlinear growth of the zonal wind error suggests that use of past errors as a simple linear correction of forecast zonal profiles is not a promising solution of the problem particularly when no provision is made for stabilization of the longest waves. In an attempt to throw some light on the remaining question of what can be done to improve the barotropic model with respect to zonal wind errors, a series of experimental forecasts is made using a form of the barotropic vorticity equation with a persistent frictional term that provides crudely for momentum sources and sinks. Although the results are, to a considerable degree, inconclusive, they suggest that future efforts should be directed toward the inclusion of friction in a more realistic atmospheric model. *Subject Headings:* **1. Zonal wind errors 2. Numerical wind forecasting 3. Barotropic models.**—*Author's abstract.*

11C–37 551.509.313:551.511.6:551.513

Burger, Alewyn P. (*National Physical Research Lab., Council for Sci. and Indust. Research, Pretoria*), **Scale consideration of planetary motions of the atmosphere.** *Tellus*, Stockholm, 10(2): 195–205, May **1958.** 9 refs., 66 eqs. **DWB, DLC**—The application of scale considerations to atmospheric motions indicates that the equations hitherto used in numerical prediction are unfit for detailed prognosis on the planetary (or very large) scale. It appears that the dominant terms of the vorticity equation in this case are the divergence term and the β-term, which means that the vorticity equation here displays the same quasi-stationary character as the undifferentiated equations of motion. An attempt at expressing more than the quasi-stationary character of the planetary flow leads to undue complication of the equation, even requiring inclusion of the twisting terms. As for the application of the geostrophic approximation, it is confirmed that the β term in the divergence equation is important in the representation of the planetary scale. Further, though metrical terms (containing the reciprocal of the earth's radius) are important on this scale in spherical coordinates, it is shown that, in using the geostrophic approximation and a square grid on a conformal plane projection of the earth's surface, no metrical terms appear. Remarks are also included on a relation of PRANDTL, which loses its validity on the planetary scale, and also on the use of the Richardson number to characterize large scale atmospheric motion. (*Same item as* 10.2–151, Feb. 1959, *MAB.*) *Subject Headings:* **1. General circulation 2. Vorticity equations 3. Numerical forecasting.**—*Author's abstract.*

11C–38 551.509.313:551.511.32:551.511.2

Bykov, V. V., **Ob uravneniiakh dinamiki atmosfery pri gipoteze kvazisolenoidal'nosti.** [Equations for dynamics of the atmosphere using the quasi-solenoidal hypothesis.] *Meteorologiia i Gidrologiia*, No. 11:8–14, Nov. **1956.** fig., 12 refs., 21 eqs. **DWB, DLC.** Transl. (p. 11–14) into English with title **On the equation of numerical prediction in relation to the nondivergence concept** by A. Nurklik, issued as *Canada. Defence Research Board, Translation*, No. 39, April **1958.** Available **DWB** (M09.3 B993on)—The solution of the equations of continuity of heat flow (adiabatic conditions) and of the hydrostatic equation for the quasi-geostrophic approximation in short range forecasting is discussed. This is followed by a detailed account of the solution of the differential equations associated with the hypothesis of quasi-solenoidality developed by CHARNEY and BOLIN. This use of this hypothesis for short range forecasting depends upon the solution of the balance equation:

$$\rho\Delta\varphi+2\left[\frac{\partial^2\varphi\partial^2\varphi}{\partial x^2\partial y^2}-\left(\frac{\partial^2\varphi}{\partial x\partial y}\right)^2\right]+\beta\frac{\partial\varphi}{\partial y}=\Delta H.$$

The solution of this equation is proposed by rewriting it in the form:

$$\Delta q=\frac{2}{\rho}\left[\left(\frac{\partial^2\varphi}{\partial x\partial y}\right)^2-\frac{\partial^2\varphi\partial^2\varphi}{\partial x^2\partial y^2}\right]-\frac{\beta}{l}\frac{\partial\rho}{\partial y}=Q(x,y).$$

The numerical solution of this equation is presented, and the physical significance of the numbers of this equation is indicated by synoptic charts. Also, the system of forecasting equations on the

assumption of quasi-solenoidality of the wind for a baroclinic atmosphere is considered. (*Same item as* 10.8–213, Aug. 1959, *MAB.*) *Subject Headings:* **1. Dynamics of the atmosphere 2. Charney-Bolin hypothesis 3. Numerical short range forecasting.**—*I.L.D.*

11C–39 551.509.31

Carlin, Albert V., **Procedure for exercise in numerical weather prediction.** *U. S. Weather Bureau, Exercise in Numerical Weather Prediction, Pamphlet* No. 2, April **1955.** 27 p. 14 figs. **DWB** (M09.312 U587ex)—Step-by-step instructions and explanations are given for computing instantaneous height tendencies from a given 500 mb chart using both the barotropic and baroclinic models. The pamphlet is intended as an exercise for those wishing to acquire the technique of numerical forecasting. *Subject Heading:* **1. Numerical forecasting techniques.**—*G.T.*

11C–40 551.509.313:551.509.324.1/.

Carlstead, Edward M., **Forecasting middle cloudiness and precipitation areas by numerical methods.** *Monthly Weather Review*, Wash., D. C., 87(10):375–381, Oct. **1959.** 4 figs., 7 refs., 9 eqs. **DWB, DLC**—A numerical prediction model suitable for computation using large-scale digital computers to forecast amounts of middle cloudiness, areas of precipitation, and precipitation amounts is presented. The model described uses products derived from an operational Joint Numerical Prediction Unit forecast model. Background information, certain mathematical equations, and input-output format are presented. Figures showing a sample series of prognostic charts are presented. Results, limitations, and future prospects are discussed. *Subject Headings:* **1. Numerical precipitation forecasting 2. Cloudiness forecasting.**—*Author's abstract.*

11C–41 551.509.313

Chang, Shih-lieh (*Peking Met. College*), **Qualitative forecasting rules in two-parameter baroclinic model.** *Acta Meteorologica Sinica*, Peking, 28(4):249–255, **1957.** 13 figs., 4 refs., 5 eqs. In Chinese; English summary p. 255. **DLC**—Based on THOMPSON and GATES' two-parameter model, the factors determining the development of absolute vorticity and the variation of thermal vorticity are discussed, and then some qualitative rules for predicting the development of large-scale disturbances are obtained. *Subject Headings:* **1. Baroclinic models 2. Numerical forecasting.**—*Author's abstract.*

11C–42 551.509.312:551.5477

*Chaplygina, A. S., **24-chasovye izmeneniia termobaricheskikh poleĭ v svobodnoĭ atmosfere.** [24-hour variations of the thermobaric fields in the free atmosphere.] *Akademiia Nauk SSSR. Geofizicheskiĭ Institut, Trudy*, No. 33(160):60–105, **1956.** 14 figs., 24 tables, 9 refs., eqs. **DLC**—Results of a statistical investigation of changes of the thermobaric field at the main isobaric surfaces, carried out on the basis of analyses of daily charts of baric topography of the Central Forecasting Institute (TSIP) for 1–10 Sept. 1950 and the months of May 1951 and 1952 are presented. The purpose of the investigations was to define more accurately the relations between changes of geopotential and horizontal transfer of vorticity and heat, as indicated by recent theory. Good agreement is found between results and theory. (*Same item as* 9.5–117, May 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2 Vorticity advection 3. 24-hour temperature change forecasts 4. Baric topography changes.**—*A.M.P.*

11C–43 551.509.313:551.542:551.509.5

†Chaplygina, A. S., **O chislennykh metodakh prognoza baricheskogo polia v atmosfere.** [Numerical methods of forecasting the atmospheric pressure field.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz.*, No. 6:823–826, June **1957.** 2 tables, 24 refs., 3 eqs. **DLC**—An attempt is made to systematize the data on numerical forecasting published during 1951–56 in order to determine the degree of success of different methods in forecasting the pressure field in the middle troposphere (forecasting changes in 500 mb surface). The coefficients of correlation between prognostic and actual variations at 500 mb obtained by methods of forecasting for the same initial data and the mean correlation coefficients between actual and forecast variations of 500 mb for different forecasting methods are presented in tables. The results obtained with various models are analyzed. It is concluded that the experimental forecasts published in the meteorological literature outside the U.S.S.R. show that the precision of forecasting the pressure field at 500 mb by numerical methods are more exact than those obtained by usual synoptic forecasting. (*Same item as* 10.3–167, March 1959, *MAB.*) *Subject Headings:* **1. Numerical pressure forecasting 2. Forecast verification 3. Forecast accuracy.**—*I.L.D.*

11C–44 551.509.313:551.511:551.513.1

Charasch, Eliahu, **Note on numerical prediction of intensity changes of disturbances with the aid of the quasi-geostrophic barotropic model.** *Tellus*, Stockholm, 10(1):95–98, Feb. **1958.** 6 refs.,

8 eqs. **DWB, DLC**—It is shown by a simple analysis that the introduction of a small but systematic error in the evaluation of vorticity causes a significant aberration in the conversion process between disturbance and basic flow kinetic energy in barotropic motion. The neglect of the variation of the coriolis parameter in the geostrophic vorticity is shown to be responsible for large errors in the prediction of the intensity changes taking place in a barotropic model. (*Same item as* 10.3–168, March 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Barotropic models 3. Vorticity calculation errors.**—*Author's abstract.*

11C–45 551.509.313

Chen, Yung-san et al. (*Inst. of Geophys. and Met., Academia Sinica*), **A test of two-parameter model for a situation with a strong front.** *Acta Meteorologica Sinica*, Peking, 28(4):275–281, **1957.** 7 figs., 5 refs., 6 eqs. In Chinese; English summary p. 281. **DLC**—The development of a situation with strong front in the Far East is computed as a test for the two-parameter model in ($xy\theta$-t) system. It is found that the result is better than that obtained from a two-parameter model in (xyp-t) system, as the front is better represented in the former model. However difficulty exists with regard to the boundary conditions in ($xy\theta$-t) system. (*Same item as* 10.3–169, March 1959, *MAB.*) *Subject Heading:* **1. Numerical forecasting.**—*Author's abstract.*

11C–46 551.509.313:551.43

Chih, Li-jen; Chao, Ming-tze and Koo, Chen-chao (*all, Inst. of Geophys. and Met., Academia Sinica*), **Tendency computations for baroclinic development under kinematic boundary condition of earth's topography.** *Acta Meteorologica Sinica*, Peking, 29(3):213–220, Aug. **1958.** 14 figs., 10 refs., 7 eqs. In Chinese; English summary p. 220. **DLC**—The computation method for the baroclinic large scale development under the kinematic boundary condition of earth's topography is considered. Two tendency computations of development over the Tien Shan-Altai region are completed with relaxation technique. The results show that over the Tien Shan-Altai region the orographical disturbance may reach as large as 70–80 m/24 hr at 700 mb and 100 m/24 hr at 900 mb level. Thus the orographical influence is of importance over that area. However, owing to the difficulty in the proper selection of surface wind used in the present model, it is suggested that the boundary condition should be reformulated. *Subject Headings:* **1. Numerical forecasting 2. Orographic effects on large-scale circulation 3. Tien Shan-Altai region.**—*Authors' abstract.*

11C–47 551.509.312:551.511:551.513.1

§Chou, Ge-fen and Liao, Hsiang-yün (*both, Central Weather Bureau, Peking*), **Some statistical study of Fjørtoft's graphical method.** *Acta Meteorologica Sinica*, Peking, 29(1):24–32, Feb. **1958.** 7 figs., 3 tables, ref., 4 eqs. In Chinese; English summary p. 32. **DWB**—The aim of this paper is to make clear the accuracy of the approximate integration formula $\Delta H = -(\Delta\xi + 2\Delta\bar{\xi})$ and the steadiness of the space mean velocity field (or space mean height field, i.e. $\bar{H}$ =field). By analyzing the change in actual field, the errors introduced by them are discussed. *Subject Heading:* **1. Fjørtoft's graphical method.**—*Authors' abstract.*

11C–48 551.509.313:551.524:551.43

Chu, Pao-chen (*Inst. of Geophys. and Met., Academia Sinica*), **A note on the orographical effect on the formation of the mean temperature field.** *Acta Meteorologica Sinica*, Peking, 28(4):315–318, **1957.** fig., table, 3 refs., 5 eqs. In Chinese; English summary p. 318. **DLC**—Taking two layer baroclinic model, as given by Sawyer and Bushby, and introducing the topographical effect, we obtain the following equations from the linearized vorticity equation and adiabatic equation [1]

$$\bar{U}\nabla^2 z + \beta z + \frac{U_T}{3}\nabla^2 h = -\frac{f^2}{gH}(\bar{U} - U_T)\eta,$$

$$\bar{U}\nabla^2 h + U_T\nabla^2 z + \bar{U}\left(\frac{\beta}{\bar{U}} - M\right)h + MU_T z = 0,$$

where $\eta = \eta(x,y)$ is the topography of the earth's surface, $H = RT_0/g$, and

$$M = \frac{4f^2}{p_0 - p_1}\frac{1}{C_2 R\Gamma p}, \qquad C_2 = \frac{p_0 + 3p_1}{p_0 - p_1} - \frac{4p_0 p_1}{(p_0 - p_1)^2}\ln\frac{2p_0}{p_0 + p_1}, \qquad \Gamma_p = \frac{\gamma d}{pg} - \frac{\partial T}{\partial p},$$

in which $p_0 = 1000$ mb, $p_1 = 200$ mb. By means of Fourier analysis, the solution of the perturbation thickness of 1000–500 mb (h) may be written in the following form

$$h(x,y) = \frac{f^2}{gH}\frac{3U_T(U - U_T)}{3\bar{U}^2 - U_T^2}\int_0^{2\pi}\int_0^{2\pi}\eta(a,\gamma)I_0(x-a, y-\gamma)\,da\,d\gamma,$$

where the influence function I_0 is given by the double series

$$I_0(x,y) = \frac{1}{4\pi^2} \sum_{\lambda,\kappa=-\infty}^{\infty} \sum \frac{M-(\lambda^2+k^2)}{(\lambda^2+k^2)+2M(\lambda^2+k^2)-\frac{3M}{2}\frac{\beta}{\bar{U}}} e^{i(\lambda x+ky)}.$$

The numerical results of winter ($u=15$ m/s, $u_T=13$ m/s) are given by the figures in the text. *Subject Headings:* **1. Orographic effects on temperature 2. Orographic effects in baroclinic models.**—*Author's abstract.*

11C–49 551.509.313:551.513:532.5

Chu, Pao-chen (*Inst. of Geophysics and Met., Academia Sinica*), **A hydrodynamical model for seasonal variation of general circulation and long-range forecasting.** *Acta Meteorologica Sinica*, Peking, 29(1):57–62, Feb. **1958.** 8 refs., 28 eqs. In Chinese; English summary p. 62. **DWB**—A hydrodynamical model suitable for numerical integration of seasonal variation of general circulation and long range forecasting is set up from hydrodynamic and thermodynamic equations with the equations of atmospheric radiation. The heating by radiation will thus depend on the motion. A system of differential equations suitable for numerical integration is derived for 2 and 3 dimensional models. *Subject Headings:* **1. General circulation models 2. Numerical long-range forecasting 3. Hydrodynamic models.**—*From author's abstract.*

11C–50 551.509.313/4:551.547.1

Cooley, Duane S. (*U. S. A. F. Camb. Res. Center, Mass.*), **Statistical forecasting operators based on dynamical equations.** *Tellus*, Stockholm, 10(3):331–341, Aug. **1958.** 6 figs., 2 tables, 11 refs., 13 eqs. **DLC**—Statistical forecasting operators are derived on the basis of a simple two-parameter model of the atmosphere. In the course of this investigation, the predictability of pressure-height changes due to the various physical processes specified by this dynamical model is investigated. It is found that the contribution of the nonlinear processes to the 12 and 24 hr predictability is small. (*Same item as* 10.7–165, July 1959, *MAB.*) *Subject Headings:* **1. Statistical forecasting from dynamic models 2. Pressure height calculations.**—*Author's abstract.*

11C–51 551.509.313:551.513.1:551.509.5

Cressman, G. P. and Hubert, W. E. (*Joint Num. Weather Prediction Unit, Suitland, Md.*), **A study of numerical forecasting errors.** *Monthly Weather Review*, Wash., D. C., 85(7):235–242, July **1957.** 15 figs., 6 refs. **DWB, DLC**—Studies of numerical forecasting errors have revealed that the principal difficulties encountered in models currently operational at the Joint Numerical Weather Prediction Unit arise from errors in the 500 mb forecasts. These errors are common to both barotropic and baroclinic models. The errors in the 1000–500 mb thickness forecasts are considerably smaller. Results show that systematic errors are introduced (1) by the use of the geostrophic approximation and (2) by the approximations used on the boundaries. The cases presented in this paper show that the first type of error is virtually nonexistent in nongeostrophic, barotropic forecasts. Boundary errors are particularly serious in cases where the boundaries are meteorologically active, suggesting the future use of hemispheric forecast grids. The elimination of these two types of errors from all forecasts appears to be essential before the smaller errors, such as truncation errors and errors due to baroclinic development, nonadiabatic effects, etc., can be isolated and studied satisfactorily. (*Same item as* 10.3–170, March 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting errors 2. Barotropic models 3. Baroclinic models 4. Geostrophic approximation.**—*Authors' abstract.*

11C–52 551.511.32:551.509.313

Cressman, George P., **Barotropic divergence and very long atmospheric waves.** *Monthly Weather Review*, Wash., D. C., 86(8):293–297, Aug. **1958.** 4 figs., table, 8 refs., 9 eqs. **DWB, DLC**—The problem of spurious retrogression of very long waves by the nondivergent barotropic forecasts is shown to be the same problem discussed extensively by Rossby, Yeh, and Bolin. The difficulty is due to the failure of the nondivergent model to allow properly for the mutual adjustment of wind and pressure fields. The equation of continuity for a homogeneous incompressible fluid with an upper free surface, proposed as a remedy by Rossby nearly 20 yrs ago, removes much of the difficulty. Further improvements are obtained by inclusion of a tropopause in the manner adopted by Bolin. The results of a series of 10 test forecasts are shown in verification of the function of the divergence in a barotropic model. (*Same item as* 10.7–186, July 1959, *MAB.*) *Subject Headings:* **1. Barotropic models 2. Divergence analysis 3. Atmospheric waves.**—*Author's abstract.*

11C–53 551.509.313:551.511.3

Das, P. K. (*Met. Office, New Delhi*), **Experiments with numerical forecasting in India.** *Meteorological Society of Japan, Tokyo, 75th Anniversary Vol. of the Journal*, pub. Nov. **1957.** p. 275–279.

2 figs., 11 refs., 4 eqs. **DWB, DLC**—CHARNEY's equation for a nondivergent barotropic model has been applied to a depression in the Bay of Bengal. The equations were solved by relaxation method, and the predicted height changes were compared with those observed. The agreement was not discouraging, although there was considerable room for improvement. The limitations of the above model, specially in low latitudes, are discussed with special reference to the nonbarotropic nature of the atmosphere and the quasi-geostrophic approximation. *Subject Headings:* **1. Numerical forecasting 2. Barotropic models.**—*Author's abstract.*

11C–54 551.509.312/3:551.515.13

Das, P. K. and Bose, B. L. (*both, Regional Met. Center, New Delhi*), **Numerical prediction of the movement of Bay depressions.** *Indian Journal of Meteorology and Geophysics*, Delhi, 9(3):225–232, **July 1958.** 11 figs., 15 refs., 3 eqs. **DWB, DLC**—The 24-hr displacement of two monsoon depressions in the Bay of Bengal was computed on the basis of the nondivergent barotropic model of CHARNEY and ESTOQUE's baroclinic model. Relaxation methods were used for the barotropic model, and FJØRTOFT's graphical technique was employed for ESTOQUE's model. The difficulties experienced with the data available, and effect of errors caused by inadequate data are discussed. Finally. the predicted contours of the 1000 and 500 mb surfaces are compared with the observed patterns and suggested lines for improvement are indicated. *Subject Headings:* **1. Numerical monsoon depression forecasting 2. Barotropic models 3. Fjørtoft's graphical method 4. Bay of Bengal.**—*Authors' abstract.*

11C–55 551.511(02) 551.509.313

†Defant, Albert and Defant, Friedrich, **Physikalische Dynamik der Atmosphäre.** [Physical dynamics of the atmosphere.] Frankfurt a.M., Akademische Verlagsgesellschaft, **1958.** Ch. 14, p. 469–491, **Numerische Wettervorhersage.** [Numerical weather forecasting.] 3 figs., table, 23 refs., 16 eqs. **DLC** (QC880.D42)—Mathematical principles of various numerical forecasting methods are described in the following sections: 1) introduction and statement of the problem, 2) three-dimensional basic equations in quasi-geostrophic approximation, 3) advective model, 4) barotropic model, 5) KIBEL'-EXNER method, 6) two-layer model by N. PHILLIPS, 7) $2\frac{1}{2}$-dimensional model by EADY, 8) comparison of the models and calculatory process of their solution, and 9) graphical integration of the barotropic vorticity equation according to FJØRTOFT. The references are to literature up to 1955. (For abstract on whole book, *see* 10.5–8, May 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Dynamic meteorology textbooks.**—*G.T.*

11C–56 551.509.313:061.3(08)

*†§Deutsche Meteorologische Gesellschaft, **Symposium über Numerische Wettervorhersage in Frankfurt a.M., vom 23. bis 28. Mai 1956.** [Symposium on numerical weather forecasting held at Frankfurt a.M., May 23–28, 1956.] *Germany. Deutscher Wetterdienst, Berichte*, 5(38), **1957.** 97 p. figs., tables, refs., eqs. (For listing of contents *see* Pt. III, p. 1036, Aug. 1958, *MAB.* Most articles abstracted separately.) **DWB, DLC**—Some twenty papers delivered at the Frankfurt a.M. symposium on numerical forecasting are given, either in their entirety or in summary form. This collection of papers represents an excellent review of present knowledge in this field of meteorology. It gives a complete idea of the modern techniques used in numerical prediction, and of the theoretical and practical aspects of this promising method of forecasting. (*Same item as* 10.9–3, Sept. 1959, *MAB.*) *Subject Heading:* **1. Numerical forecasting symposia.**—*A.V.*

11C–57 551.509.313:551.547

DÖÖS, Bo R. (*Inst. of Met., Univ. of Stockholm*), **Automation of 500 mb forecasts through successive numerical map analyses.** *Germany. Deutscher Wetterdienst, Berichte*, 5(38):24, **1957.** 2 refs. Abstract only in English and German. **DWB, DLC**—During the autumn of 1954 the meteorological section of the Royal Swedish Air Force in cooperation with the Meteorological Institute of the University of Stockholm carried out a series of routine computations of barotropic forecasts. For this purpose 72 forecasts were computed during Dec. 1954–May 1955; they were resumed in autumn of 1955. The method of numerical analysis of the 500 mb surface is presented in **Numerical weather map analyses** by Páll Bergthórsson and B. R. Döös (*see* 8F–8, June 1957, *MAB.*) *Subject Headings:* **1. Barotropic forecasts 2. Numerical forecasting.**—*I.L.D.*

11C–58 551.509.313:551.543

Dubov, A. S. and Orlova, L. S., **Rezul'taty prognoza nazemnogo polia davleniia i kart baricheskoĭ topografii grafoanaliticheskim metodom.** [Results of forecasts of the surface pressure field and pressure topography maps by the graphic-analytical method.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 71:34–48, **1957.** 7 figs., 11 tables, 3 refs., eqs. **DWB** (M(055) U581tG)—In the numerical forecasting of surface pressure and 500 mb heights, the solution of the equations in finite differences was accomplished by the use of rectangular grid with an interval of 440 km. The

computation of the daily variations involved three transfers, namely transfer of surface pressure on the basis of a principal flow, transfer of 500 mb contours and of 500/1000 thickness according to a second and third principal flow. The variations were obtained as linear combinations of these transports averaged along circles with a radius of 440 and 620 km and the values of the transports at the point itself. The equations of the structure of the several flows and the equations for determining daily variations in the pressure field (in mb) and the isohypse of the 500 mb surface (in decameters) are presented. The forecast area and the region of the initial data comprise almost all of Europe including European Russia. The validity of the graphic-analytical method was less than that of the synoptic method, in particular as it failed to indicate the appearance of new pressure formations. The actual pressure changes at the 500 mb surface were correlated separately with the results of transports along the three principal flows. The correlation coefficients indicate marked differences among the results of transports in accordance with the principal flow and variations of surface pressure at the 500 mb surface. Also a method of calculating surface pressure variations and 500 mb contours using 1955 data and involving only two transports is outlined. The results confirm those of 1954. The actual variations were closely associated with the results of transport in the region surrounding the point than with the results of transport at the point itself. *Subject Headings:* **1. Surface pressure fields 2. Numerical pressure forecasting 3. Graphic-analytical methods 4. Pressure variations.**—*I.L.D.*

11C–59 551.509.59:551.542:533.16:539.62

Dubov, A. S., **Ob uchete prizemnogo treniia pri prognoze polia davleniia u zemli.** [Consideration of surface friction in forecasting the pressure field near the ground.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 71:66–71, **1957.** fig., 4 tables, 2 refs., 14 eqs. **DWB** (M(055) U581tG)—An analysis of the effect of turbulent friction upon pressure change in differential form shows that the inclusion of terms describing vertical turbulent transfer alters somewhat the relationship between the temporally and spatially derived geopotential. Practically, this variation appears simultaneously with terms taking into account the effect of vorticity advection and temperature and of a supplementary term associated with the Laplacian of surface pressure at a given moment. An approximate solution was obtained by M. I. Iudin who, using the equation of motion of an ideal fluid, considered the influence of surface friction and assumed it to be proportional to the Laplacian of surface pressure. An approximate method for calculating the surface pressure field by means of the graphical analytical method is presented. It is assumed that the pressure at a given point consists of two parts: the first is produced by the advection of vortical velocity and temperature and the second by surface friction. The former produces the principal effect on pressure change while the latter provides merely a correction. Equations are derived for determining the pressure effect. The computation of the effect of surface friction indicates that the verification of the pressure field forecast was increased by 5% in a year and the relative error is diminished by 11%. A procedure for obtaining a better correction is developed and equations for actual calculations are derived. *Subject Headings:* **1. Pressure forecasting 2. Pressure fields 3. Surface friction.**—*I.L.D.*

11C–60 551.509.312:519.241.1

Dunn, Carlos R. (*Extended Forecast Sec., U. S. W. B., Wash., D. C.*), **Automatic incorporation of numerical short-range prognoses in 5-day circulation forecasts.** *Monthly Weather Review*, Wash., D. C., 86(2):45–52, Feb. **1958.** 3 figs., 2 tables, 8 refs., 5 eqs. **DWB, DLC**—One of the basic aids in the preparation of extended forecasts is a 5-day mean mid-tropospheric chart centered on the day of the forecast, with associated instantaneous height tendencies, the unknown data being computed by autocorrelation techniques. Substitution of values from the barotropic 24-hr and 48-hr numerical prognoses for these unknowns objectively incorporated recent gains in short-period prognoses. Comparison of the statistically and physically computed mean charts and their tendencies suggests superiority of the latter over North America and the Atlantic, but not over the Pacific where errors in the barotropic prognoses, which are probably due to improper boundary assumptions and omitted physical processes, play an important role. Dynamic considerations can be applied to the new mean chart to suggest subsequent changes which may not be indicated kinematically. (*Same item as* 9.11–139, Nov. 1958, *MAB.*) *Subject Headings:* **1. Extended forecasting 2. Autocorrelation techniques 3. Barotropic tendency computation.**—*Author's abstract.*

11C–61 551.509.313:551.515.1/7

Dushkin, P. K.; Lomonosov, E. G. and Tatarskaia, M. S., **Prognoz tsiklo- i antitsiklogeneza s pomoshch'iu vychislitel'noĭ mashiny.** [Forecasting cyclogenesis and anticyclogenesis with a computer.] *Meteorologiia i Gidrologiia*, Leningrad, 6:11–16, June **1959.** 4 figs., table, 4 refs., 4 eqs. **DWB, DLC**—Owing to the fact that when the barotropic model is used in forecasting the mean pressure field at 700 or 500 mb the correlation coefficient may vary considerably from instance to instance and that unsatisfactory forecasts are observed during the baroclinic transformation and intense evolution of the pressure field at the mean level, the three dimensional baroclinic model

the atmosphere is being used in numerical forecasting. In this article the numerical forecast of the pressure field at several levels is based upon the integral solution of N. I. Buleev and G. I. Marchuk, namely:

$$\zeta(0,0,\zeta) = \frac{1}{2\pi}\int_0^{\prime}\int_0^{\infty}\int_0^{2\pi} m^2 \frac{l}{g} A_\Omega(\eta,r,\varphi) M_1(\zeta,\eta,r) r\,dr\,d\varphi\,d\eta + \frac{1}{2\pi}\int_0^{\prime}\int_0^{\infty}\int_0^{2\pi} \frac{R}{g} A_T(\eta,r,\varphi) M_2(\zeta,\eta,r) r\,dr\,d\varphi\,d\eta$$

where $\zeta = p/p_0$ = derived pressure, p_0 = 1000 mb, T = temperature on the absolute scale, R = specific humidity constant of dry air, $m^2 = \frac{R^2\bar{T}(\bar{\gamma}_a - \bar{\gamma})}{gl^2}$ designates mean value within the limits of the troposphere; γ_a, γ = dry adiabatic and actual vertical temperature gradient respectively; $A_\Omega = \frac{g^2}{l^2}(z,\Delta z) - \beta\frac{g}{l}\frac{\partial z}{\partial x}$ dynamic and $A_T = -\frac{g}{l}(z,T)$ thermal factors; $M_1(\zeta,\eta,r)$, $M_2(\zeta,\eta,r)$ = functions of influence. The actual solution of this equation and its application to specific situations are illustrated. It is concluded that the use of multilevel baroclinic forecast patterns even within the framework of the usual physical approximation (quasi-stationary quasi-geostrophic adiabatic) gives more accurate forecasts of cyclo- and anticyclogenesis in the free atmosphere. *Subject Heading:* **1. Baroclinic models.**—*I.L.D.*

11C–62 551.509.312/3:551.511:551.513.1

Duvedal, T., **Model for advection of pressure tendencies on surface charts and advective tendencies on thickness charts.** *Annalen der Meteorologie*, Hamburg, 8(3/4):64–72, **1957.** 15 figs., table, 3 refs. **DWB, DLC**—The numerical forecasting of prognostic charts with the aid of the barotropic model on the electronic computer gives streamline patterns at 500 mb, but in routine forecasts a prognostic sea level chart is more convenient. For this purpose observed 3 hr pressure tendencies are used in Sweden, in order to extrapolate 24 hr changes. The observed three-hour pressure tendencies are used to construct a sea level chart with the aid of the conventional prognostic method. After this a 24-hr prognostic chart for thickness 1000–500 mb is made by using previous 24 hr thickness and predicted position of fronts. The resulting prognostic 24-hr thickness chart is added to the prognostic sea level charts which result in a prognostic 500 mb chart. The routine of computation by the electronic calculator is described and the relevant formula is given. Twelve 24-hr forecasts for selected weather situations were made and computed, and observed sea level and 500 mb charts for selected areas of Europe are presented. The correlation between the computed 24-hr change and observed change of topography and the "skill" (S) computed by the formula $S = \frac{R_\phi(PA_v) - R_\phi(AA_v)}{1 - R_\phi(AA_v)}$ are presented. $R_\phi(AA_v)$ = correlation between observed topography A, at time 0, and observed topography A_v at time t, and R (PA_v) = correlation between computed topography P and observed topography at time t. The results for both the forecasts made by means of a barotropic model and with numerical methods are presented in a table. The advective method yielded for the 1000 mb prognostic chart, a correlation coefficient of chart +0.80 and a mean error between 20 m and 40 m which means a slightly better result than that of the prognostic sea level charts made at the Swedish Weather Service. The correlation for the 500 mb chart is more variable. In general in both instances the barotropic model gives slightly higher correlation coefficients but the advective method is quite promising. *Subject Headings:* **1. Numerical forecasting 2. Pressure tendencies 3. Prognostic charts 4. Barotropic models 5. Sweden.**—*I.L.D.*

11C–63 551.511.3:551.509.313

Edelmann, Winhart (*Deutscher Wetterdienst, Frankfurt a.M.*), **Vergleich verschiedener dreidimensionaler Modelle der Atmosphäre mittels Lösungen linearisierter Gleichungen.** [Comparison of various three-dimensional models of the atmosphere by means of solutions of linearized equations.] *Germany. Deutscher Wetterdienst, Berichte*, 5(38):25–30, **1957.** fig., 2 tables, numerous eqs. **DWB, DLC**—The author compares various three-dimensional models of the atmosphere in order to determine their characteristic differences. These include the geostrophic advection model, without and with stability, the model with geostrophic stream function, the Thompson model, the nongeostrophic advection model (without stability), the noise model, the Hollmann-model and the W′ model. The linearized equations of these models are analyzed. A stationary zonal fundamental flow is assumed and a small disturbance is imposed upon it. Solutions for the fundamental barotropic flow, closed solutions for the baroclinic fundamental flow and approximate solutions for the baroclinic fundamental flow are presented. (*Same item as* 10.8–211, Aug. 1959, *MAB.*) *Subject Headings:* **1. Atmospheric models 2. Linear equations 3. Numerical forecasting.**—*I.L.D.*

11C–64 551.511.3:551.509.3

†Edelmann, Winhart, **Vergleich verschiedener nichtgeostrophischer Modelle der Atmosphä mit Hilfe von Lösungen der linearisierten Modellgleichungen.** [Comparison of different nc geostrophic atmospheric models with the aid of solutions of the linearized model equations.] *Berl Freie Universität. Institut für Meteorologie und Geophysik, Meteorologische Abhandlungen*, 6(1), 19 215 p. 50 figs., 26 refs., 144 eqs. Biog. sketch appended. **DWB.** English version issued Germany. Deutscher Wetterdienst, Contract AF 61(514)-735 C, Technical (Final) Report, June **1957.** Sec. 5(150 p.) 50 figs., 26 refs., 144 eqs.—A sizeable monograph developing in detail line equations for a nongeostrophic model of the atmosphere. As yet, these equations have not be sufficiently linearized or simplified to allow their use in electronic computers. The general proble is first outlined; in Ch. II—the physical basis (equations of state, continuity, etc.) is discussed; C III—the meteorological equations (geostrophic vorticity, divergence, adiabatic and boundary cond tions); IV—the various 3-dimensional models (geostrophic, Philipps, Thompson, Hollmann, adve tion, etc.); V—linearized model equations, their integration and energy considerations; VI—tim dependent solutions in barotropic flow; VII—tendency circulations for initially barotropic pe turbations in a baroclinic current; VIII—time dependent 3-dimensional solutions in baroclinic flo IX—general time dependent solutions for 2-layer models in baroclinic flow. Models are show graphically as well as mathematically. (*Same item as* 10.7–27, July 1959, *MAB*) *Subject Heading* **1. Nongeostrophic models 2. Numerical models.**—*M.R.*

11C–65 551.509.313:551.513

Estoque, M. A., **Dynamical prediction of the Arctic circulation.** *Tellus*, Stockholm, 12(1):41–5 Feb. **1960.** 11 figs., 2 tables, 4 refs. **DLC.** Also: McGill Univ. Arctic Meteorology Researc Group, Contract AF 19(604)-1141, Scientific Report, No. 4, Oct. **1957.** 10 p. 12 figs., nu merous charts, 2 tables, 4 refs. **DWB** (919 M145s)—The results of a series of experimenta forecasts of the 500 and 1000 mb flow patterns over the Arctic during January 1956 are discusse The forecasts were made by integrating graphically the equations of a simple baroclinic model. summary of the performance of the model and an analysis of the errors are presented; some cha acteristics of the Arctic circulation are deduced from these error patterns. In general, the result suggest that the model is capable of producing useful forecasts over the Arctic. *Subject Heading* **1. Numerical Arctic circulation forecasting 2. Baroclinic models 3. Arctic.**—*Author's abstract.*

11C–66 551.511:551.509.312:551.4

Estoque, Mariano A., **A graphically integrable prediction model incorporating orographi influences.** *Journal of Meteorology*, 14(4):293–296, Aug. **1957.** 5 figs., 2 tables, 6 refs., 10 eqs **DWB**—Error patterns of sea level prognoses over N. America are closely related to Rocky Mts. T incorporate effects of sloping terrain a 2-level model is used and procedure described with an example Incorporation of orographic effect resulted in a great improvement of the forecast. (*Same item a* 8.11–141, Nov. 1957, *MAB*.) *Subject Headings:* **1. Numerical forecasting 2. Orographic effects** —*C.E.P.B.*

11C–67 551.509.31

Flohn, Hermann (*Frankfurt a.M.*), **Entwicklung, Stand und Aussichten einer mathematische Wettervorhersage.** [Development, present status and prospects of mathematical weather forecast ing.] *Physikalische Blätter*, Mosbach/Baden, 12(10):442–452, **1956.** 17 refs. **DLC**—This objective review starts with Vilhelm Bjerknes' definition of forecasting and considers briefly all significant contributions including dimensional and technical developments leading up to the threshold of 4-D forecasting techniques where meteorology approaches meteoronomy. The article summarizes the exchange of ideas and views of the 35 participants from 12 nations meeting at Frankfurt a.M., May 23–28, 1956. *Subject Headings:* **1. Numerical forecasting 2. Forecasting techniques.**—*W.N.*

11C–68 551.509.313:551.509.5

Flohn, Hermann (*Deutscher Wetterdienst, Frankfurt/Main*), **Zur Bedeutung der numerischen Wettervorhersage für den praktischen Dienst.** [Importance of numerical forecasting for practical service.] *Germany. Deutscher Wetterdienst, Berichte*, 5(38):31–32, **1957.** 2 tables. **DWB, DLC**—The fundamental results of numerical forecasting are discussed. The unrealistic barotropic computation model surpasses in performance the empirical kinematic methods of forecasting. The geostrophic baroclinic models are less productive than the barotropic models. The time required for computation on the more efficient machines (1 hr) is considerably less than that needed for the collection of observations, analysis and preparation of input data (6–9 hrs). A speed-up can be achieved by a method of objective analysis based upon the correction of 12 or 24-hr forecasts by means of observed values of geopotential and wind. In the case of the models of several levels, the quality of the results increases from the ground upwards while in the case of empirical procedures the forecasts are poorer for the upper layers than for the ground. The importance of boundary conditions

ecomes more evident. In contrast to these positive results there are also some negative ones. hus the mean error of the predicted changes of the geopotential or of the pressure increases with me in most models and is greater than in the case of empirical procedures. The extension of umerical forecasting to the preparation of forecast charts for 200, 150 and 100 mb surfaces prediction f vertical motion in the troposphere as well as of precipitation, prediction of the true paths of rajectories, forecasting of smogs, etc., are discussed. *Subject Headings:* **1. Numerical forecasting . Numerical forecasting evaluation 3. Barotropic models.**—*I.L.D.*

11C–69 551.509.313:551.515.11

§Franke, Martin, **Ein Entwicklungssatz als Mittel zur Prognose auf Grund der hydro-thermo-lynamischen Gleichungen einer trockenen, reibungslosen, baroklinen, kompressiblen Modell-tmosphäre.** [Development theory as a means of forecasting based on hydro-thermodynamic quations assuming a dry, frictionless, baroclinic, compressible model atmosphere.] *Geofisica Pura Applicata*, Milan, 35:94–125, Sept./Dec. **1956.** 10 figs., 13 refs., 32 eqs. English summary p. 94. **DLC**—It is shown theoretically that a combination of hydrodynamic concepts (vorticity, pressure, Sutcliffe's theory) and of thermodynamic concepts (dynamic lability, solenoids, baroclinic field, ntropy) gives a closer approach to the development of weather than a purely hydrodynamic method. The result is an equation based on a model of dry, baroclinic, compressible atmosphere without riction. In practical application, summary charts of wind shear, vorticity and entropy provide a good method of forecasting, especially of cyclogenetic development. A close connection is found between 24-hour isallobars and regions of persistent rainfall associated with currents toward descending vorticity *and* descending entropy. (*Same item as* 9.5–118, May 1958, *MAB.*) *Subject Headings:* **1. Weather forecasting 2. Sutcliffe's development theory 3. Hydro-thermodynamic concepts.**—*Author's abstract.*

11C–70 551.509.313:551.511.32

Gambo, K. (*Met. Res. Inst., Japan*), **Equations of motion for small scale disturbances.** *Meteorological Society of Japan, Tokyo, 75th Anniversary Vol. of the Journal*, pub. Nov. **1957.** p. 108–115. 4 figs., 8 refs., 11 eqs. **DWB, DLC**—In this paper, the author attempts to make clear the physical means of the internal and gravitational waves by using the dimensionless equations of motion. The small scale disturbances in the typhoon or near the frontal surface are also discussed in connection with the Rossby number. Since the effect of horizontal divergence or convergence is large compared with the vorticity in such cases, the internal gravitational wave whose character changes when the condensation occurs predominates. As a numerical example, we discuss how the initial small scale disturbances develop with increasing time in the case where the divergence of horizontal velocity is considerably larger than the vorticity. *Subject Headings:* **1. Equations of motion 2. Numerical forecasting.**—*Author's abstract.*

11C–71 551.509.313:551.511.32

Gambo, K. (*Geophysical Inst., Tokyo Univ.*), **Three-dimensional treatments of equations of motion without using the geostrophic approximation.** *Meteorological Society of Japan, Tokyo, Journal, Ser.* 2, 35(1):1–11, Feb. **1957.** 2 figs., 14 refs., numerous eqs. **DWB, DLC**—The use of the geostrophic approximation gives rise to inertio-gravitational oscillations which are meteorologically unimportant "noise" disturbances. In the first part of this paper, the physical explanations about the occurrence of those inertio-gravitation oscillations are given in the case of barotropic atmosphere. In the latter part of this paper, the general method for filtering out the "noise" in the three-dimensional atmosphere is proposed. Such a treatment is discussed by introducing G-number which is the ratio of the velocity potential χ to the stream function ψ. This G-number simplifies the equations we are concerned with and also the associated discussions. The quasi-geostrophic equations hitherto used correspond to those of zero order of G-number. *Subject Headings:* **1. Equations of motion 2. G-number 3. Numerical forecasting techniques.**—*Author's abstract.*

11C–72 551.509.313:551.515.11:551.509.324.2

Gambo, Kanzaburo; Saito, Naosuke; Fujiwara, Shigemi et al., **Numerical predictions of the development of the cyclone over the Far East and the associated precipitation.** *Germany. Deutscher Wetterdienst, Berichte*, 5(38):36–47, **1957.** 22 figs., 10 refs., numerous eqs. German and English summaries p. 36. **DWB, DLC**—The authors discuss the development of a cyclone on the basis of the equation of absolute vorticity in which the height change with respect to time depends upon the horizontal and vertical advection of absolute vorticity and the divergence of horizontal velocity field. In this equation

$$\frac{\partial z}{\partial t} = \nabla^{-2} J(\eta, z) - \nabla^{-2}\left(\frac{f}{g}\omega\frac{\partial \eta}{\partial p}\right) + \nabla^{-2}\left(\eta\frac{f}{g}\frac{\partial \omega}{\partial p}\right)$$

The correct estimation of the development of a cyclone depends primarily upon correct estimation of

the Jacobian J and the reciprocal expression of ∇^{-2} operator and of the quantity $\nabla^{-2}\left(\eta\frac{f\partial\omega}{g\partial p}\right)$. Th estimation of the Jacobian by the integral relaxation method and of the height change with respe to time by using the advection of absolute vorticity or the gradient of the vertical p-velocity wi respect to pressure p are discussed. The accuracy of the developed method for computing th vertical p-velocity the calculated pressure pattern on the earth was compared with the observed on and good agreement was found. The mechanism of the rapid intensification of a cyclone whic passed over the Japan Sea to the Sea of Okhotsk in one day (May 9, 1954) is analyzed by numeric integrations of the equation of absolute vorticity using the methods developed for correctly estimati the Jacobian and height change with respect to pressure. The numerical prediction of amount precipitation is made by means of the simplified equation. *Subject Headings:* **1. Numerical cyclon development forecasting 2. Absolute vorticity 3. Numerical precipitation forecasting. I. Mura kami, Takio.**—*I.L.D. and authors' summary.*

11C–73 551.511:551.509.313:551.4

Gambo, K. (*Met. Res. Inst., Japan*), **The scale of atmospheric motions and the effect of to pography on numerical weather prediction in the lower atmosphere.** *Papers in Meteorology an Geophysics*, Tokyo, 8(1):1–24, April **1957.** 14 figs., 14 refs., numerous eqs. **DWB**—In the first pa of this paper, the orders in magnitude of each term in the vorticity equation, the divergence equatio and the equation of the vertical p-velocity are discussed as functions of the Rossby-number. As th first approximation of such equations, the quasi-geostrophic approximation is used. The secon approximation is also discussed in connection with the balance equation. In this case it is to b emphasized that the most important problem is how to filter out the meteorologically unimportan "noise" of disturbances. In the second part of this paper, the effect of topography on the heigh change with time in the lower atmosphere is considered from the point of view of scale-quantity The vertical p-velocity due to the effect of topography is divided into two parts: one is the large scale pattern which contributes to the height change with time in the lower atmosphere and the othe is the small-scale pattern which contributes only to the precipitation without changing the pressur pattern on the earth's surface. In the last part of this paper, these theoretical results are compare with good agreement with the observed pressure change with time on the earth's surface. *Subje Headings:* **1. Numerical forecasting 2. Orographic effects.**—*Author's abstract.*

11C–74 551.509.313:551.51

Gates, W. Lawrence (*U. S. Air Force Cambridge Res. Center*), **A dynamical model for large-scal tropospheric and stratospheric motions.** *Royal Meteorological Society, Quarterly Journal*, 83(356) 141–160, April **1957.** 6 figs., table, 36 refs., 59 eqs. **DWB**—A physical model of the atmosphere is postulated in which both the troposphere and stratosphere are characterized by a uniform therma wind and a constant static stability, and are separated by a tropopause across which these quantities are discontinuous. Assuming the tropopause to be quasi-isobaric, a simplified model for the mean velocity, temperature and vertical motion fields of both the troposphere and stratosphere, the velocity near the earth's surface, and both the horizontal and vertical motion at the tropopause is constructed. The model may be regarded alternatively as a four-parameter or four-level model but it is felt to avoid the primary disadvantages of the exclusive use of either the parameterized or layered formulation. Analysis of the special case of an equivalent-barotropic stratosphere indicates the existence of systematic tropopause variations, with the vertical motion at this level generally in phase with that of the mid-troposphere, and with a system of opposing vertical motion higher in the stratosphere. These features are in general agreement with the results of observational and synoptic research, although the details of the role of the tropopause must await further calculations. The analysis of the stability of tropospheric perturbations in a baroclinic zonal current shows a stabilizing influence of the stratosphere on the initial amplification of the disturbances. The minimum vertical shears required for instability with a basic jet current of 40 m sec^{-1} are more than twice those required without a stratosphere, and are shown to lie between the mean summer and winter shears in the zone of maximum westerlies. (*Same item as* 8.8–168, Aug. 1957, *M.A.B.*) *Subject Heading:* **1. At mospheric models.**—*Author's abstract.*

11C–75 551.509.313:551.513.1

Gates, W. L., **Hemispheric numerical forecasting with the barotropic model and some remarks on boundary-condition error.** *Journal of Meteorology*, 14(4):332–342, Aug. **1957.** 13 figs., 2 tables, 11 refs., eq. **DWB**—A barotropic model was used for forecasting 2-dimensional 500 mb quasi-geostrophic motion for Jan. 16–25, 1953, for 24, 48 and 72 hrs. General accuracy decreased up to 72 hrs; best performance was eastern U. S. (correlation of observed and predicted 24-hr changes >.95). Accumulation of forecast errors is shown by results for Jan. 22, and improvement of accuracy by hemispheric scheme over limitation to N. America is pointed out. Causes of forecast errors are discussed under numerical manipulations, those inherent in the physical model (especially

ignoring of baroclinicity) and those due to inadequacies of observations. Research on these is in progress. (*Same item as* 8.11–142, Nov. 1957, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Barotropic models.**—*C.E.P.B.*

11C–76 551.509.313

Gates, W. L. (*Calif. Univ. L. A.*), **On the truncation error, stability, and convergence of difference solutions of the barotropic vorticity equation.** *Journal of Meteorology*, Boston, 16(5):556–568, Oct. 1959. 10 figs., 5 tables, 11 refs., 78 eqs. **DWB, DLC**—The truncation error, stability and convergence properties of various finite-difference formulations of the one-dimensional barotropic vorticity equation are considered, and analytic solutions of the difference equations for simple harmonic initial conditions are presented. With conventional centered space differences, the schemes considered may be classified according to the method of time differencing as the forward difference case (unstable), the first-forward-then-centered difference case (conditionally stable), and the implicity difference case (unconditionally stable). The first-forward-then-centered difference scheme, corresponding to that commonly employed in meteorological numerical integration, gives rise to an oscillation phenomenon in both the amplitude and phase speed of the solution, which is most serious for a small space mesh, a large time mesh, and for the shorter wave length disturbances. In each difference scheme considered, the truncation error leads to a cumulative phase departure of the difference solution relative to the true solution, an effect which is approximately proportional to the cube of the wave length. *Subject Headings:* **1. Truncation error 2. Integration techniques 3. Barotropic vorticity equations.**—*Author's abstract.*

11C–77 551.511:551.509.313

Germany. Deutscher Wetterdienst, **Studies in numerical weather forecasting.** Contract AF 61(514)-735 C, Technical (Final) Report, June 30, 1957. Sections A–Q (each separately paged). figs., tables, refs., eqs. "Work under the present contract covers the period July 1, 1954–June 30, 1957, and contains a continuation of the investigations published in the Final Report under Contract AF 61(514)-434 "Research on objective weather forecasting," during July 1, 1953–June 30, 1954 (*see* 6.11–143, Nov. 1955, *MAB.*) **DWB** (M09.312 G373st)—The 16 papers included in this final report are mainly concerned with analytical problems as the Group had no access to an electronic computer, except toward the end of the work. The main research objectives were: 1) evaluation of efficiency and shortcomings of geostrophic and quasi-geostrophic prediction models, 2) development of ageostrophic prediction models and 3) analysis of the atmospheric processes of development and the physical mechanisms involved. All but four of the articles are translations of papers published elsewhere (for listing of contents see Pt. III, p. 1460, Nov. 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Geostrophic forecasting models 3. Ageostrophic forecasting models. I. Hinkelmann, K.** (*ed.*) **II. Flohn, H.** (*ed.*).—*G.T.*

11C–78 551.511:551.509.313

Gião, Antonio, **Analyse géostrophique des champs de pression et de température.** [Geostrophic analysis of pressure and temperature fields.] *Geofisica Pura e Applicata*, Milan, 35:73–93, Sept./Dec. **1956.** 6 figs., 2 tables, 2 refs., 39 eqs. English summary p. 73. **DLC**—A general equation is derived for the development of the geostrophic fields. This equation leads to the definition of a function (S) of the pressure gradient and the temperature which plays an essential part in the discussion of the stability conditions of the pressure and temperature fields. The theoretical configurations of the pressure field, when S is constant in space, form well defined families of fields comprising all the stationary fields. By means of these families any complex field can be analyzed through its resolution into simple fields with symmetry properties with respect to their central meridians. A method for the rational classification of weather types can be based on this geostrophic analysis and is applied here to the European mean pressure fields for the months of July and Jan. (*Same item as* 9.5–119, May 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Geostrophic equations.**—*Author's abstract.*

11C–79 551.509.313

Gilchrist, Bruce, **The effects of numerical weather prediction on current observing and forecasting practices.** *Weather Radar Conference, Proceedings of the Fifth . . . Conference, Sept. 1955*, p. 23–26, pub. **1956. DWB**—Computing machines are intended to help the meteorologist and not to replace him. In Washington a joint Weather Bureau, Air Force and Navy units is working to produce three level numerical predictions for North America and the adjacent waters. The author explains the limitations of present weather forecasting and the fact that numerical weather predictions are limited to observations of temperature, pressure, winds and humidity at about five levels in the atmosphere. Data requirements of numerical forecasting and practical prospects of developing the necessary observation networks are discussed. *Subject Heading:* **1. Numerical forecasting.**—*N.N.*

11C–80 551.511:551.509.313

Godart, O., **Modèle atmosphérique.** [Atmospheric model.] *Société Scientifique de Bruxelles, Louvain, Annales*, 69(1):85–101, June **1955.** 4 figs., 8 refs., 49 eqs. **DLC**—Weather forecasting by numerical calculation may only be done for simplified atmospheric models. For the one proposed by the author, the isobaric convergence is always supposed to be null at the 500 mb isobaric level. Besides this, certain relatively small quantities, bound to the vertical movement and to the oblateness of the earth, are neglected. The chosen spatial co-ordinates are, for the first two: the Cartesian co-ordinates on the stereographical projection of the earth's surface, and for the third: the height above the level of the sea of an adiabatic atmosphere of reference having the same pressure as the real atmosphere. The field of the speeds is completely determined through two potentials: the former being a potential of flux and the latter a potential of evolution, which can be calculated through integrating linear equations with elliptic partial derived functions of the second order, starting from observations of heights and temperatures of the isobaric surfaces. The forecast is made through the integration of a Poisson's equation and of linear parabolic equations of the first and second order. *Subject Headings:* **1. Atmospheric models 2. Numerical forecasting.**—*A.V.*

11C–81 551.509.313:551.532:551.511.32

Götz, Gusztáv and Tanczer, Tibor, **Az áramlási mezö számszerű előrejelzésének hidrodinamikai alapjai.** [Hydrodynamical bases of a numerical forecasting of the flow pattern.] *Időjárás*, Budapest, 62(2):90–98, March/April **1958.** 7 refs., 35 eqs. Hungarian and English summaries p. 90. **DWB, DLC**—Hydrodynamical bases are set up serving as a starting-point for up-to-date numerical forecasting of the atmospheric flow pattern. The authors start from the thesis that the vector of velocity is determined by the vorticity- and divergence-fields. Vorticity- and divergence-fields can be computed thus by integrating the differential equations of the vorticity and divergence on the period of the interval of the prognose. A prognostic equation suitable for practical purposes can be obtained by expressing the vorticity from the equations of motion of the applied atmospheric model by means of the components of velocity, and by solving the differential equations on the local variation of the geopotential. *Subject Headings:* **1. Numerical air flow forecasting 2. Vorticity-divergence fields 3. Atmospheric flow pattern.**—*Authors' abstract.*

11C–82 551.509.313

Götz, Gusztáv, **A barotróp nyomáselőrejelzési módszerek egyszerűsítő es határfeltételeiről.** [On the simplifying and boundary conditions of barotropic pressure-forecasting methods.] *Időjárás*, Budapest, 62(6):338–343, Nov./Dec. **1958.** 4 refs., 18 eqs. English summary p. 338. **DLC**—In the course of investigating the numerical forecast of weather elements the introduction of several simplifying conditions is required because of the character of atmospheric processes and the complexity of the meteorological equations. Distinction is made between generally used conditions, the applying of which is rendered possible by the nature of the task, and special conditions of equilibrium, the use of which is required by the solving of the problem of forecast. Owing to the limits of geostrophic approximation the introduction of the so-called balance-equation seems to be more appropriate, by the aid of which the forecasting of the pressure-field will be reduced to the solving of the barotropic vorticity equation. In order to solve this Poisson-equation artificial limiting conditions must be laid down for the boundaries of the range of forecast. The physically correct determination of these will not conduce any instability of calculation. *Subject Headings:* **1. Barotropic models 2. Boundary-value problems.**—*Author's summary.*

11C–83 551.511(02) 551.509.313

Haltiner, George J. and Martin, Frank L., **Dynamical and physical meteorology.** N. Y., McGraw-Hill, **1957.** Ch. 22, p. 387–414, **Dynamic forecasting by numerical methods.** 5 figs., 18 refs., 64 eqs. **DLC** (QC861.H12)—This chapter contains a detailed description of various models used in numerical forecasting and mathematical techniques used in solving them. After a general introduction, the simple barotropic model and its solution by means of the relaxation method and graphical methods are explained. Among the more complex baroclinic models, the equivalent barotropic model, the advective model, the two-parameter model, the two-level model and some further refinements are discussed. Stability properties and structure of baroclinic waves are given detailed consideration. (For abstract on the whole book, *see* 9.4–5, April 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Dynamic meteorology textbooks.**—*G.T.*

11C–84 551.509.312:518.4

Haltiner, George J. and Hesse, Theodore S. (*both, U. S. Naval Post-graduate School*), **Graphical prognosis including terrain effects.** *Journal of Meteorology*, 15(1):103–107, Feb. **1958.** 5 figs., table, 6 refs., 19 eqs. **DWB, DLC**—A method for the graphical integration of the vorticity equation is presented, which includes the effects of terrain-induced vertical velocities. The prediction equation is applied to a series of 1000 mb charts. The tests show that the inclusion of the terrain factor

materially improved the prognosis in mountainous areas. When applied to the 500 mb chart, there was no significant improvement, primarily because of an additional severe assumption relating the surface and 500 mb winds. *Subject Headings:* **1. Graphical integration 2. Numerical forecasting techniques 3. Terrain effect on vertical velocities.**—*Authors' abstract.*

11C–85 551.509.313:518.12

Haselberg, K. von, **Relaxation procedures for solving the Poisson equation.** Germany. Deutscher Wetterdienst, Contract AF 61(514)-735 C, Technical (Final) Report, June 30, **1957.** Sec. G (13 p.) 13 figs., 2 refs., 12 eqs. **DWB** (M09.312 G373st)—The procedures described in this paper are based on the equation $\nabla^2 x = R$ in a rectangular grid with $x_R = 0$ on the boundary. The operator ∇ defines the finite difference operator corresponding to the Laplacian operator:

$$\nabla^2 x_{iR} = \begin{pmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{pmatrix} x_{iR}.$$

The solution proposed can also be applied to other approximations, to more dimensions and more general linear systems of equations. Although the method is not novel and has been extensively treated in mathematical literature, the author feels justified in discussing it from the point of view of meteorological application, as it eliminates some of the shortcomings of methods now used in numerical forecasting. Both total and single-step procedures are considered. *Subject Headings:* **1. Poisson's equations 2. Numerical forecasting techniques 3. Relaxation methods.**—*G.T.*

11C–86 551.509.313:518.4

Haug, Odd (*Norwegian Met. Inst., Oslo*), **Some results of numerical weather prediction with a Lagrangian method.** *Germany. Deutscher Wetterdienst, Berichte,* 5(38):51–52, **1957.** fig., table, eqs. Abstract only in English and German. **DWB, DLC**—The practical application of the Lagrangian method (FJØRTOFT, *Tellus,* 7(4):462–480, Nov. **1955**; *see* 7.11–140, Nov. 1956, *MAB*) to the barotropic model. The barotropic vorticity equation is written in the form

$$\frac{\partial}{\partial t}(\nabla^2\psi + f) = -(V^{(N)} - \mathfrak{C}\cdot\nabla(\nabla^2\psi + f))$$

where $V^{(N)} = kx\nabla\psi^{(N)}$, $\psi^{(N)} = \psi + \frac{1}{\alpha_N}\nabla^2\psi$, and $\mathfrak{C}$ is a zonal velocity of magnitude $\frac{2\Omega}{\alpha_N R}\cos\psi$. The Fjørtoft trajectory scale is applied in order to displace the vorticity in the smoothed field. The procedure of carrying out the forecasts includes the following: the x and y wind components in a hexagonal grid with $d \approx 600$ km and read off directly from the map. The x and y components of $V^{(N)}$ and $V^{(N)(N-P)}$ are computed by means of given equations. The determination of 12 hour displacements on the constructed grid, the determination of trajectories and the computation of vorticity tendencies and absolute vorticity are described. Some results obtained with this method are presented. *Subject Headings:* **1. Numerical forecasting techniques 2. Barotropic vorticity equations 3. Fjørtoft's graphical method.**—*I.L.D.*

11C–87 551.509.313:551.509.5

Herrlin, Oscar (*Com. Mil. Weather Service. Stockholm*), **Numerical forecasting at the Swedish Military Meteorological Office in 1954–1956.** *Germany. Deutscher Wetterdienst, Berichte,* 5(38):53–55, **1957.** 3 figs. German summary p. 53. **DWB, DLC**—During the course of two periods, Dec. 1, 1954–May 31, 1955, and Nov. 1, 1955–May 1, 1956, the Weather Service of the Royal Swedish Air Force carried out routine barotropic forecasts for 24, 48 and 72 hrs by means of the Stockholm electronic computer BESK. In the first period subjective analyses of 0300 H were used, from these the height values were read off at the individual grid points and fed into the machine as the initial field; in the second period the forecasts were based upon a numerical analysis of the 1500 H observations. For each period the time required to make a forecast was determined, verifications were made and comparisons were made with the results obtained by means of conventional procedures. The advantages of the numerical method include the objective nature of the forecast, earlier knowledge of large scale weather changes, easier forecasting of cyclone tracks, easier recognition of possible baroclinic developments and saving in personnel and time. *Subject Headings:* **1. Numerical forecasting evaluation 2. Electronic computer applications 3. Forecast verification 4. Sweden.**—*Transl. of author's abstract.*

11C–88 551.509.33:518.5

Hess, Paul, **Numerische Wettervorhersage: der einzige Weg, auf dem langfristige Wettervorhersagen möglich sind.** [Numerical weather forecasting: the only practical method for long

range weather forecasting.] *Orion*, Munich, 11(5/6):248–250, March **1956. DLC** (Q3.O75)— The general principles of numerical prediction and the currently used techniques, machines used in the U. S. and Sweden and their limitations and the possibilities for extended forecasting and, hopefully, for longer periods are elucidated. Interpretation of flow patterns in terms of "weather" is still up to the meteorologist and will be for some time. (*Same item as* 9G–78, July 1958, *MAB.*) *Subject Heading:* **1. Numerical long range forecasting.**—*M.R.*

11C–89 551.509.313:551.513.2:551.515

Hess, Seymour L., **A simplified theory of long waves on baroclinic westerly current.** Florida. State Univ. Dept. of Meteorology, Contract NONR-1600(00), Project NR-082-071, Technical Report No. 11, May 1, **1958.** 18 p. 3 figs., table, 6 refs., 23 eqs. **DWB**—A simplified, quasi-geostrophic, baroclinic theory of long waves is presented. By elimination of the geopotential from the divergence equation it is possible to relate the three velocity components by three independent equations. No more are needed. Simple solutions are obtained at the price of losing instability of the waves. The vertical motion ties the waves together vertically. The relationship of vertical motion to the profiles of the zonal wind is examined. Possible extensions to long-range forecasting are discussed. *Subject Headings:* **1. Waves in the westerlies 2. Baroclinic models.**—*Author's abstract.*

11C–90 551.511.3:551.509.313

Hinkelmann, Karl (*Deutscher Wetterdienst, Frankfurt a.M.*), **Über die Einbeziehung divergenter Windkomponenten in Vorhersagemodelle.** [Inclusion of divergent wind components in forecasting models.] *Germany. Deutscher Wetterdienst, Berichte*, 5(38):56–63, **1957**, fig., 4r efs., 47 eqs. Eng. transl. included in Germany. Deutscher Wetterdienst, Contract AF 61(514)-735 C, June 30, **1957**, Technical and Final Report. Section B (21 p.). **DWB**—In this mathematical theoretical paper the author, using a simple example, examines the degree to which the use of extended wind equation—which takes into account transport by nongeostrophic wind instead of the quasigeostrophic model—modifies forecasts. The geostrophic wind equation is extended by including a vector that is derivable from the velocity potential. While this extension avoids the principal defects of the geostrophic model, its results become unrealistic in regions of almost disappearing absolute vorticity. (*Same item as* 10.8–212, Aug. 1959, *MAB.*) *Subject Headings:* **1. Geostrophic equations 2. Wind divergence 3. Numerical models.**—*I.L.D.* (*based on author's summary*).

11C–91 551.509.313:551.511.3

Hinkelmann, K., **Ein semigeostrophisches Vorhersagemodell und sein Randwertproblem.** [Semigeostrophic prediction model and its marginal value problem.] *Germany. Deutscher Wetterdienst, Berichte*, 5(38):64, **1957.** eq. Abstract only. **DWB, DLC.** English transl. as: Germany. Deutscher Wetterdienst, Contract AF 61(514)-735C, Technical (Final) Report, June 30, **1957.** Sec. E (26 p.). 7 refs., 57 eqs. **DWB** (M09.312 G373st)—A forecasting model using a weak form of the geostrophic approximation is presented. In the adiabatic equation

$$\frac{\partial T}{\partial t} + V \cdot \nabla T = \sigma\omega, \qquad \sigma = -L \frac{\partial \ln \theta}{\partial p}$$

the vertical velocity ω is approximated geostrophically in such a way that an elliptic differential equation for ω taken from the theory of quasi-geostrophic equations is solved; the solution function of ω depends simply upon the distribution of the geopotential at the time $\phi\ (x,y,p,t=0)$ considered. In further equations ω is defined by the equation of continuity. *Subject Headings:* **1. Geostrophic approximation 2. Boundary-value problems. I. Germany. Deutscher Wetterdienst II. Contract AF 61(514)-735C.**—*I.L.D.*

11C–92 551.511.3:551.509.313

Hollmann, Günther (*Deutscher Wetterdienst, Frankfurt a.M.*), **Ein nichtgeostrophisches Integrationsverfahren unter Ausschluss externer und interner Gravitationswellen.** [An ageostrophic integration method which disregards external and internal gravity waves.] *Germany. Deutscher Wetterdienst, Berichte*, 5(38):65–67, **1957.** 4 refs., 27 eqs. **DWB, DLC**—When the tendency equation

$$\int_0^{P_0} D\partial p = -\rho_0 \frac{\partial \phi_0}{\partial t}$$

is included in ageostrophic computations two frequencies additional to the synoptic frequency are obtained. These belong to the external gravitation-inertia oscillations. The role of the inertial oscillation in the frequencies is less important since the corresponding phase oscillation is considerably less than that of gravity oscillations. The elimination of internal gravity waves appearing in a

hydrostatic stable stratified atmosphere by using a filter operator in the thermodynamic equation is illustrated. The individual (linearized) operator which filters out internal gravity waves in the adiabatic equation can be used also in the tendency equation to filter out external gravity waves. On account of the continuity equation $D = -\partial\omega/\partial p$ the tendency equation to be used as lower marginal condition in the case of ageostrophic motions is written $p = p_0 : \omega = \rho(Q\phi - fUv)$. In order to filter out the gravity waves this equation is used instead:

$$p = p_0 : \left(\frac{f^2+Q^2}{f^2}\right)\omega = \rho(Q\phi - fUv).$$

The integration method is presented. *Subject Headings:* **1. Integration techniques 2. Gravity waves 3. Numerical forecasting.**—*I.L.D.*

11C–93 551.55:551.542.1:551.509.313

Hollmann, G., **Über die Grenzen der geostrophischen Approximation und die Einführung nichtgeostrophischer Methoden.** [The limits of the geostrophic approximation and the introduction of ageostrophic methods.] *Germany. Deutscher Wetterdienst, Berichte,* 5(38):68–70, **1957.** 4 refs., 34 eqs. **DWB, DLC**—In this study, the author examines the compatibility of the geostrophic approximation with the barotropic vorticity equation, with the baroclinic vorticity equation and with the thermodynamic equation. The selective geostrophic approximation is useful in practice only in the case of baroclinic developments of fields of small amplitude and temporal variations of kinetic energy. All other cases to which the deepening of cyclones belongs are not satisfactorily expressed by the geostrophic approximation. (*See also* 7.10–198, Oct. 1956, *MAB.*) *Subject Headings:* **1. Geostrophic approximation 2. Numerical forecasting.**—*I.L.D.*

11C–94 551.509.313

Hollmann, G., **Zur Frage der Lärmfilterung in den hydro-thermodynamischen Gleichungen.** [On the question of noise filtering in hydro-thermodynamic equations.] *Beiträge zur Physik der Atmosphäre,* Frankfurt a.M., 31(1/2):5–30, **1958.** 17 refs., 174 eqs. German, English and French summaries p. 5–6. **DWB, DLC.** English transl. as: Germany. Deutscher Wetterdienst, Contract AF 61(514)-735C, Technical (Final) Report, June 30, **1957.** Sec. A (37 p. 14 refs., 174 eqs.).—Since the geostrophic approximation is limited in its application to numerical forecasting, complete hydro- and thermodynamic equations must be used for this purpose. Their application is limited by the noise problem which involves the propagation of sound and gravity waves. The filtering of the various noise frequencies by means of the frequency method and the use of linearized equations is presented in this paper. Sound waves are filtered by the hydrostatic approximation. Gravity waves are filtered by distinguishing between external and internal gravity waves. "In a hydrostatically stratified atmosphere both forms of gravity waves appear simultaneously. The phase velocity of these mixed waves degenerates when the hydrostatic stability approaches a critical value. This phenomenon results because the hydrostatic approximation becomes unsatisfactory in too stable an atmosphere since the wave length of the assumed perturbations is no longer large compared to a defined height of the atmosphere." By assuming vanishing vertical motion at the surface and at the boundary of the atmosphere, gravitational waves can be suppressed. This assumption produces a relatively small error in the frequency of the synoptic wave. A filtering operator, which leaves the synoptic wave unaffected, filters external gravity waves when applied to the tendency equation and filters internal gravity waves when applied to the thermodynamic equation, is defined. "Only the synoptic and two vertical equation frequencies remain if the filtering operator is applied." In a barotropic basic field, the pressure field is free of inertial oscillations even if the perturbations are baroclinic. It is shown with the aid of difference calculations that the time step used in quasi-geostrophic calculations guarantees numerical stability also in the case of inertial oscillations." For a baroclinic two-layer model, the frequency equation is derived with and without noise filtering and compared with the quasi-geostrophic system. The neutral value with regard to baroclinic instability appears for all three frequency equations at the same wave length. *Subject Heading:* **1. Numerical forecasting errors.**—*Author's summary and I.L.D.*

11C–95 551.509.313:551.515.11

Hollmann, G., **Transformation der Grundgleichungen der dynamischen Meteorologie in Koordinaten der stereographischen Projektion zum Zwecke der numerischen Vorhersage.** [Transformation of the basic equations of dynamic meteorology into stereographic projection coordinates for numerical forecasting purposes.] *Beiträge zur Physik der Atmosphäre,* Frankfurt a.Main, 31(3/4):162–176, **1959.** fig., 12 refs., 90 eqs. German, English and French summaries p. 162–163. **DWB, DLC**—As is well known, the circumpolar areas are not mapped on an equal-area projection of the earth's surface. For the purpose of numerical weather forecasting the basic equations of

dynamic meteorology are here transformed into Cartesian coordinates of the distorted plane of stereographic projection, and a three-dimensional image of the atmosphere is obtained. It is necessary to introduce a suitable definition of the velocity, the "reduced image velocity." The absolute value of the (real) wind on the sphere is equal to the absolute value of the reduced image wind on the distorted plane of projection multiplied by the scale distortion. Wind divergence and vorticity on the sphere are equal to the corresponding quantities of the reduced image wind multiplied by the square of the scale distortion. Surface integrals of various hydrodynamic properties of the reduced image wind are very simply related to the corresponding surface integrals on the sphere. In the equations of motion for the reduced image wind a force appears which is always directed to the northpole. It is caused by the scale distortion. The balance equation which is used up to now in the barotropic model allows for the scale distortion only in an incomplete manner. It is shown on the example of a cyclonic circumpolar vortex that the zonal velocity thus computed is too small because of this inaccuracy. *Subject Headings:* **1. Numerical forecasting for polar areas 2. Polar vortexes 3. Stereographic projection.**—*Author's abstract.*

11C–96 551.509.313:551.509.322.7:551.558

§Hollmann, G. and Wegner, K. O., **Approximative Berechnung der Vertikalbewegung ausgewählter Wetterlagen.** [Approximate calculations of vertical motions in selected weather situations.] *Beiträge zur Physik der Atmosphäre*, Frankfurt a.Main, 31(3/4):200–216, **1959.** 5 figs., table, 8 refs., 27 eqs. German, English and French summaries p. 200. **DWB, DLC**—With the aid of the assumptions on which the barotropic model of numerical forecasting is based, a formula is developed for the approximate computation of vertical motion at 700 mb which can be treated relatively simply. With this formula the vertical motion during 40 weather situations was computed at 20 grid points. These motions were evaluated according to synoptic-statistical viewpoints. Vertical motions of a few cm/sec were obtained which show, at least, good qualitative agreement with the synoptic experience relating to the distribution of hydrometeors. These vertical motions are compared with those obtained by means of the thermotropic model. The differences between the results can easily be explained by the differing assumptions concerning the models. *Subject Headings:* **1. Vertical motion calculations 2. Vertical motion forecasting 3. Barotropic models.**—*Authors' abstract.*

11C–97 551.509.312:551.511 551.509.317:551.547

Huber-Pock, Franz (*Vienna*), **Vergleichende Untersuchungen zur graphischen Integration der barotropen Wirbelgleichung.** [Comparative study of the graphical integration of the barotropic vorticity equation.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, Vienna, 11(1):29–37, **1959.** 5 figs., 2 tables, 5 refs., 5 eqs. German, English and French summaries p. 29–30. Also his: **Ein statisches Verfahren zur Verbesserung und Beschleunigung der graphischen Integration der barotropen Wirbelgleichung.** [Statistical method for improvement and acceleration of graphical integration of barotropic vorticity equations.] *Ibid.* p. 38–47. 3 figs., 4 refs., 6 eqs. German, English and French summaries p. 38–39. **DWB, DLC**—(For abstract, *see* 10.10–172, Oct. 1959 *MAB.*) *Subject Headings:* **1. Barotropic vorticity equations 2. Graphical integration 3. Fjørtoft's graphical method.**

11C–98 551.509.313:551.515.2

Hubert, Lester F. (*U. S. W. B.*), **An operational test of a numerical prediction method for hurricanes.** *Monthly Weather Review*, Wash., D. C., 87(6):222–230, June **1959.** 21 figs., 2 tables, 9 refs., 2 eqs. **DWB**—Seventeen forecasts of hurricane tracks, each up to 72 hrs, were made by numerical methods under operational conditions as a test of KASAHARA'S (5) prediction model. Although the small size of the sample precludes making firm conclusions, the results here obtained compare unfavorably with the regularly issued subjective forecasts. In general, the forecast motion is too slow and to the right of the actual hurricane track. *Subject Headings:* **1. Numerical hurricane forecasting evaluation 2. Hurricane forecasting.**—*Author's abstract.*

11C–99 551.515.2:551.509.31

Hubert, L. F., **Test of numerical hurricane prediction under operational conditions.** Chicago Univ. Dept. of Meteorology, Contract Cwb 9482, Technical Report No. 9, Jan. **1959.** 17 p. 2 figs., 2 tables, 4 refs., 2 eqs. **DWB** (M15.2 C532te)—Fourteen forecasts based on a numerical method developed by the University of Chicago are evaluated. The JNWP 500 mb machine analyses were used with modified data substituted at 288 field grid points. The author concludes that "due to the tendency of the balance equation to produce small-scale, unrealistic patterns that . . . can be disastrous to a point trajectory, some space-smoothing of the stream function field seems required," and suggests the use of his surface filling technique. *Subject Headings:* **1. Numerical hurricane forecasting 2. Numerical forecasting evaluation.**—*G.T.*

11C–100 551.509.313:551.515.23

Hubert, William E. (*Joint Numerical Weather Prediction Unit, Suitland, Md.*), **Hurricane trajectory forecasts from a non-divergent, non-geostrophic, barotropic model.** *Monthly Weather Review*, Wash., D. C., 85(3):83–87, March **1957.** 6 figs., table, 5 refs., 3 eqs. **DWB, DLC**—A numerical method for obtaining trajectories from nondivergent, nongeostrophic, barotropic forecasts is presented. The wind used in the computation of direction and speed of movement is derived from a Least Squares cubic surface fitted to sixteen stream-function values surrounding the point of interest. One-hour time steps are used. The method is applied to the forecasting of hurricane tracks and useful results are obtained for periods up to 36 hrs. Several other uses of trajectory forecasts are suggested. (*Same item as* 9.5–121, May 1958, *MAB.*) *Subject Headings:* **1. Trajectory forecasting 2. Hurricane track forecasting 3. Barotropic models 4. Numerical forecasting.**—*Author's abstract.*

11C–101 551.509.312:551.556:532.593

Hubert, W. E., **A preliminary report on numerical sea condition forecasts.** *Monthly Weather Review*, Wash., D. C., 85(6):200–204, June **1957.** 5 figs., 8 refs., eqs. **DWB, DLC**—Since July 1956 the Joint Numerical Weather Prediction Unit at Suitland, Md., has been making machine forecasts of sea conditions on an operational basis. These prognoses are based on the 1000 mb wind forecasts derived from the two-level, thermotropic model currently in use at JNWP. Two different sea-forecast models have been tested to date. The first utilized only the forecast winds at the end of the forecast period and, therefore, yielded "fully developed waves." A model incorporating "duration" in a crude manner is now in daily operation. This paper describes both methods, compares the numerical results with observed conditions, and outlines future plans. (*Same item as* 9.9–113, Sept. 1958, *MAB.*) *Subject Headings:* **1. Numerical sea condition forecasting 2. Sea forecast models.**—*Author's abstract.*

11C–102 551.509.313:551.501.7

Hubert, W. E., Wolff, P. M. and Cave, C. L. (*all, Joint Numerical Wea. Pred. Unit., Suitland, Md.*), **A comparison of JNWP trajectory forecasts with transosonde flights.** *Monthly Weather Review*, Wash., D. C., 86(2):53–59, Feb. **1958.** 11 figs., 3 refs. **DWB, DLC**—Eleven charts show the respective trajectories at 300 mb (as computed by machine at the Joint Numerical Prediction Unit at Suitland) and the observed transosonde tracks during Nov. 1957 from Japan across the Pacific to the U. S. (9 cases) and from Calif. across the U. S. to Mid-Atlantic (2 cases). The JNWP forecast trajectories, using HUBERT'S (1957) method, are consistent with observed trajectories. *Subject Headings:* **1. Transosonde trajectories 2. Joint Numerical Weather Prediction (JNWP) trajectory forecasts 3. North Pacific.**—*M.R.*

11C–103 551.509.313:551.509.313:628.14:621.38

Hübner, Ch., **Note on barotropic forecasts with UNIVAC FACTRONIC I.** Germany. Deutscher Wetterdienst, Contract AF 61(514)-735 C, Technical (Final) Report, June 30, **1957.** Sec. H (11 p.) 8 figs., 2 refs., eqs. **DWB** (M09.312 G373st)—A program prepared from a barotropic model for Remington Rand UNIVAC computer is described. Prognostic charts (24, 48 and 72 hrs ahead) obtained in test runs of the program and verification charts are presented and compared. *Subject Headings:* **1. Numerical forecasting 2. Prognostic charts 3. Electronic computers.**—*G.T.*

11C–104 551.509.1:551.509.313

Hunter, Marvin N. (*U. S. W. B., Nat'l. Airport, Wash., D. C.*), **A technique for processing teleprinter copy of numerical weather-prediction data.** *American Meteorological Society, Bulletin*, 40(7):333–335, July **1959.** 4 figs. **DWB, DLC**—Numerical 500 mb prognostic data is now being transmitted on the Service C circuit. The procedure of transcribing this data on a map and then analyzing it in the conventional manner takes some 20 to 30 min. Lines indicating contour heights can be drawn on the teleprinter copy, and then an overlay map can be placed on the analyzed teleprinted copy to delineate the geographical areas on the teleprinter copy. Salient features of the map can be determined within 3 to 5 min by this procedure. *Subject Headings:* **1. Numerical forecasting techniques 2. Data transmission systems.**—*Author's abstract.*

11C–105 551.509.312:551.515.2

Itoo, H. and Masuda, Y. (*both, Met. Res. Inst.*), **The numerical prediction of the typhoon movement by the relay computer.** *Papers in Meteorology and Geophysics*, Tokyo, 7(4):377–389, Jan. **1957.** 13 figs., 3 refs., 5 eqs. **DWB**—Using the relay computer, numerical predictions of the typhoon movement are performed by the barotropic model successively with many time steps of small time interval. In the problem of typhoon prediction, the large truncation errors, especially near the typhoon center, seriously affect the forecast of typhoon movement. So, in this paper, to reduce

such truncation errors, a certain smoothing procedure is taken and the barotropic forecast is applied to the smoothing map at 700 mb and 500 mb level. (*Same item as* 9.4–100, April 1958, *MAB.*) *Subject Headings:* **1. Numerical typhoon movement forecasting 2. Truncation errors.**—*Authors' abstract.*

11C–106 551.509.313:551.542

†Iudin, M. I., **O prognoze polia davleniia chislennymi metodami.** [Forecasting pressure fields by numerical methods.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy,* No. 71:3–33, 1957. 6 figs., 2 tables, 29 refs., 91 eqs. **DWB** (M(055) U581tG)—The author presents the bases of the graphic-analytical method of forecasting pressure fields, a working method of graphic computations, and recent developments in the procedure of calculations with electronic computers. The contents of this study include the following: the physical relationships underlying contemporary methods of numerical forecasting, and derivation of the equation for determining the pressure field; the problem of the variation of the mean geopotential of a column of air with time; solution of the problem of the variations of a geopotential isobaric surface with time; the graphic-analytical method of integrating the equations of atmospheric dynamics; and the solution of the various equations of atmospheric dynamics; and the solution of the various equations with the aid of electronic computers. *Subject Headings:* **1. Numerical pressure forecasting 2. Pressure fields 3. Graphic-analytical methods.**—*I.L.D.*

11C–107 551.509.313

Iudin, M. I., **O putiakh razvitiia fizicheskikh osnov chislennogo kratkosrochnogo prognoza.** [Development of physical bases for numerical short range forecasting.] *Meteorologiia i Gidrologiia,* Leningrad, No. 2:46–51, Feb. 1959. 2 figs., table, 16 refs., 5 eqs. **DWB, DLC**—The author examines critically a series of fundamental problems of the theory of short range numerical forecasting and proposes some ways of solving them. Particular attention is paid to the forecasting of the geopotential at the mean level taking into account the influence of vorticity advection upon variation of the geopotential. A comparison of the Poisson and Helmholtz equations shows that vorticity advection over distances where $r > 25 \times 10^3$ km does not influence the variation of the geopotential at a given point. If the area is adjacent to the point where the influence is a maximum, then the effect of vorticity advection upon variation in geopotential from distances r to $r+\delta r$ is a rapidly oscillating and gradually diminishing absolute magnitude so that positive and negative vorticity advections cancel each other out over large distances. In determining the variation of the geopotential with time from the equation $\varphi_\tau = \int G(r) \overline{lA_\Omega(r)} r dr$, where $G(r)$ = function of influence, $lA_\Omega(r)$ = mean value of vortical advection multiplied by l for circumference of radius r, the equation is solved by computing integrals from rapidly fluctuating magnitudes so as to eliminate the errors from artificial boundaries within which variation in the geopotential is to be determined. The solution of this problem by considering the mean level of a relatively homogeneous layer of the troposphere instead of the entire atmosphere, the superiority of the baroclinic over the barotropic model, the accuracy of the methods of solving the spatial problem by equations referring to different levels, the forecasting of wind fields, the effect of orography on atmospheric flow, etc., are discussed. *Subject Headings:* **1. Numerical forecasting 2. Boundary-value problems.**—*I.L.D.*

11C–108 551.509.312:551.515.23

Kasahara, Akira (*Univ. of Chicago*), **The numerical prediction of hurricane movement with the barotropic model.** *Journal of Meteorology,* 14(5):386–402, Oct. 1957. 14 figs., 2 tables, 13 refs., 59 eqs. **DWB**—In order to increase the accuracy of prediction of hurricane movement beyond that which has been obtained with methods now in use, a numerical procedure based upon the barotropic model is presented here. A vortex field is separated from the total flow to obtain the residual-steering flow field. By solving the equation for the steering field, which does not include any parameters related to the vortex, the prediction of the steering flow is executed in the ordinary manner. By solving the other equation, which includes the interaction terms between the hurricane and the steering flow, the movement of the vortex pattern is predicted. To make the latter problem more tractable, a velocity formula for the movement of the vortex center is derived on the basis of a few reasonable assumptions concerning the structure of the vortex and of the steering field. The variables in the formula are expressed only in terms of quantities determined by the steering field and a single characteristic parameter related to the scale of the hurricane. By this means, a forecast of the hurricane movement can be programmed as a subroutine which is executed in the course of the prediction of the steering flow. Five cases of predicting the 24-hr and 48-hr movements of hurricane "Diane" and "Connie" (Aug. 1955) at the 500 mb level are presented here. These results have been obtained by the use of a high-speed computer, from initial maps which were re-analyzed using all available data. (*Same item as* 9.2–174, Feb. 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Hurricane propagation.**—*Author's abstract.*

11C–109 551.509.313:551.511:551.513.1

Kasahara, A., **A comparison between geostrophic and nongeostrophic numerical forecasts of hurricane movement with the barotropic steering model.** *Journal of Meteorology*, Boston, 16(4):371–384, Aug. **1959.** 13 figs., 2 tables, 15 refs., 13 eqs. **DWB, DLC.** Also issued as: Chicago. Univ. Dept. of Meteorology, Contract Cwb 9227, Technical Report, No. 7, Aug. **1958.** 27 p. 14 figs., 7 tables, 13 refs., 22 eqs. **DWB** (M15.2 C532te)—The steering flow of a hurricane is obtained by eliminating the vortex pattern from the total flow field. The evolution of the steering flow is predicted by solving the barotropic nondivergent vorticity equation. Based upon the steering flow prediction, a forecast of the hurricane movement is obtained with the use of an equation which provides for interaction between the hurricane and the steering flow. In the geostrophic model, the geostrophic wind assumption is used in solving the vorticity equation. In the nongeostrophic model, the stream function governed by the "balance equation" is adopted. With the above two prediction models, 45 pairs of predictions of the 24-hr and 48-hr movement of hurricanes "Diane" and "Connie" (August 1955) and "Betsy" (August 1956) at the 500 and 700 mb levels were prepared by the use of an electronic computer. A detailed comparison between performances of the two prediction models is presented. Generally speaking, there is a remarkable similarity between the nongeostrophic and geostrophic forecasts of hurricane movement. The accuracy of the 700 mb hurricane forecasts appears to be comparable with that obtained from the 500 mb forecasts. However, for both prediction models, the "resultant" forecast, which is the vector mean of the 700 and 500 mb predicted displacements, provides significant improvement over the accuracy of a single-level barotropic forecast. The present analyses suggest that further improvements are possible by advancing the prediction model from the barotropic model to the equivalent barotropic or baroclinic model. *Subject Headings:* **1. Hurricane movement forecasting 2. Barotropic models 3. Baroclinic models 4. Numerical hurricane forecasting.**—*Author's abstract.*

11C–110 551.509.313:551.515.23

Kasahara, A., **A numerical method of predicting hurricane movement with a two-level baroclinic model.** Chicago. Univ. Dept. of Meteorology, Contract Cwb 9482, Technical Report No. 10, Aug. **1959.** 59 p. 15 figs., 5 tables, 22 refs., eqs. **DWB** (M15.2 C532te)—A steering method of predicting hurricane movement is formulated based upon a two-level baroclinic model. The upper steering flow field is constructed from the pressure weighted mean of the 200 and 500 mb steering height fields, and the lower-level steering field from the pressure weighted mean of the 700 and 1000 mb steering height fields. Here, the steering flow of a hurricane is defined as the residual field after eliminating the vortex pattern from the total flow field. The evolutions of the upper and lower steering flows are predicted simultaneously by solving the two-level steering flow vorticity equations. Based upon those steering flow forecasts, the movement of a hurricane is predicted with the use of an equation which is derived from a solution of two vortex vorticity equations. A side condition is imposed that the upper and lower vortex patterns should move with the same velocity in the corresponding steering flow fields. Ten cases of predicting the movement of hurricane "Betsy" (Aug. 1956) up to 48 hrs are presented. A preliminary comparison of the forecasts with those obtained from the barotropic model is also made. *Subject Headings:* **1. Numerical hurricane forecasting 2. Baroclinic models.**—*Author's abstract.*

11C–111 551.509.313

Kashin, K. I. and Belousov, S. L., **Predvychislenie pogody.** [Numerical forecasting of weather.] *Nauka i Zhizn'*, Moscow, No. 5:40–42, May **1956.** illus. **DLC**—A popular-scientific account of the present situation and future potentialities of physico-mathematical forecasting "first successfully carried out by I. A. Kibel' in 1940" and developed since then in the U.S.S.R., the U. S. and other countries. The synoptic charts which may be prepared by these methods, for short range and ultimately for long range forecasting, are described and illustrated. The purpose of these machine methods is to increase the speed and accuracy of preparation of forecasts, but it is assumed that weather processes follow precise physical laws. (*Same item as* 9.8–130, Aug. 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting. I. Kibel', I. A.**—*M.R.*

11C–112 551.509.313:551.588.2:551.547

Kawata, Y. (*Geophysical Inst., Tokyo Univ.*), **The influence of the Rocky Mountains on nonsteady isobaric height patterns.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 35(3):174–183, June **1957.** 19 figs., 11 refs., eqs. **DWB, DLC**—Concerning the influence of mountains on large scale isobaric height pattern, most of the investigators up to now discussed the subject under the assumption of steady state. But recently the problem of the influence of mountains on nonsteady height pattern has attracted much interest from investigators in this field, because the results of numerical weather prediction of the lower layer are not satisfactory in mountain regions. Therefore, we examined the influence of the Rocky Mountains in nonsteady state, by solving the vorticity equation numerically. We adopted typical model height patterns in middle latitudes as the initial

conditions, and we compared the patterns obtained for the case, in which we take into account the effect of the mountains, with those for the case in which we do not take it into account. (*Same item as* 10.2–148, Feb. 1959, *MAB.*) *Subject Headings:* **1. Isobaric surfaces 2. Topographic influences 3. Rocky Mountains.**—*Author's abstract.*

11C–113 551.509.312:551.509.25

Keng, H. Y., **Graphical method for preparing 24-hour 500-mb prognostic charts.** *Meteorological Bulletin*, Formosa, 4(2):6–10, June **1958.** 3 figs., table, 3 refs., eqs. In Chinese; English summary p. 6. **DLC**—This article is a verification of the Fjørtoft's graphical forecasting method, which consists of (1) determining the distribution of vorticity at the 500 mb level, (2) displacing the vorticity field with a mean flow to a position 24 hrs in the future, and (3) integrating the forecast change of vorticity to obtain the forecast change of height. An abbreviated and modified procedure has been discussed in this paper. *Subject Headings:* **1. Fjørtoft's graphical method 2. Prognostic charts.**—*Author's abstract.*

11C–114 551.509.312(02)

†Kibel', Ivan Afanas'evich, **Vvedenie v gidrodinamicheskie metody kratkosrochnogo prognoza pogody.** [Introduction to hydrodynamic methods of short range weather forecasting.] Moscow, Gos. Izd-vo Tekhniko-Teoret. Lit-ry, **1957.** 375 p. 98 figs. (some folded), foot refs., numerous eqs. **DLC** (QC995.K5)—This is a text on hydrodynamic methods of short range forecasting by the renowned author and teacher of single station numerical weather forecasting. More advanced theoretical texts have been published by KOCHIN, KIBEL' and ROZE (*see* 6.5–7, May 1955 and 9.11–7, Nov. 1958, *MAB*) and by BELINSKIĬ (*see* 9.10–6, Oct. 1958, *MAB*), but this is the first standard text on hydrodynamic numerical prediction and is completely authoritative. The twelve (12) chapters which are replete with both theory and illustrative diagrams and synoptic charts are concerned with: (1) boundary layer problems of the atmosphere, (2) hydrodynamic and thermodynamic equations applied to the free atmosphere, (3) the order or scale of atmospheric motions, (4) setting up the equations for forecasting and relating motions to the geostrophic, (5) forecasting for midtropospheric levels (various models and linearization problems), (6) extrapolation of linear or quasisolenoidal equations for forecasting, (7) basic prognostic equations, use of Green's function for transformation of meteorological parameters with time and for vertical motions (geopotential), (8) nonlinear forecast problems for mid-levels and use of electronic computers, with various models used in U.S.S.R. and abroad, (9) extrapolation of nonlinear equations and solution by electronic computers, (10) frontal zones and frontal surfaces, solenoidal movements, (11) orographic and frictional effects, (12) thermal transformations and forecasting for the stratosphere. Synoptic applications are as a rule for Europe or Eurasian sectors of the Northern Hemisphere 500 mb charts, but sometime for 700 mb. References are to the major works of Soviet and Western authors. (*Same item as* 10.2–13, Feb. 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting textbooks 2. Short range hydrodynamic forecasting.**—*M.R.*

11C–115 551.509.313:551.511.32

Kibel', I. A., **Vydelenie geostroficheskogo dvizheniia pri prognoze pogody.** [Geostrophic motion in weather forecasting.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 60:3–9, **1957.** ref., 24 eqs. **DWB** (M(055) U581tts)—Short range forecasting methods are based upon the hypothesis of quasistationary state and quasigeostrophic motion. Basically the problem is reduced to determining future values of the geopotential H; by retaining the hypothesis of quasistationary state and rejecting that of quasigeostrophicity, a system of three equations is obtained for determining H and also the projection of velocity along the horizontal axis of

$$\frac{du}{dt} - \frac{\zeta^2}{c^2}\frac{\partial u}{\partial \zeta}\frac{d}{dt}\left(\frac{\partial H}{\partial \zeta}\right) = -\frac{\partial H}{\partial x} + lv$$

$$\frac{dv}{dt} - \frac{\zeta^2}{c^2}\frac{\partial v}{\partial \zeta}\frac{d}{dt}\left(\frac{\partial H}{\partial \zeta}\right) = -\frac{\partial H}{\partial x} - lu$$

$$\frac{\partial}{\partial \zeta}\left[\zeta^2 \frac{d}{dt}\left(\frac{\partial H}{\partial \zeta}\right)\right] = C^2\left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}\right).$$

Independent variables comprise the horizontal coordinates X and Y, the reduced pressure $\zeta = \frac{1}{P}$ (p—pressure, P—standard pressure at sea level) and the time t; l—Coriolis parameter; $C^2 = RT$ R—gas constant, T—mean temperature, $\theta = \frac{(\gamma_a - \gamma)R}{g}$ (g—acceleration of gravity, γ—mean vertica

temperature gradient, γa—adiabatic gradient).

$$\frac{d}{dt} = \frac{\partial}{\partial t} - u\frac{\partial}{\partial x} + v\frac{\partial}{\partial y}.$$

On the assumption of a small velocity when these equations can be linearized in relation to the equilibrium state ($u = v = 0 \iota H = \overline{H}(\zeta)$), it can be shown that for any initial values of velocities u_0, v_0, u_1, v_1 motions rapidly approach the geostrophic. The stationary state of the limiting function $H\alpha$ and the field of velocity, indicate that the linear problem cannot embrace the evolution of the process, so that time scales can be substantially different for the process of evolution and for the process of adaptation of motion to the geostrophic. The adaptation of the motion to the geostrophic in the nonlinear case and the nature of the gradual evolution of meteorological elements are analyzed mathematically and the validity of the quasigeostrophic method of forecasting is demonstrated. (*Same item as* 10.8–157, Aug. 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting techniques 2. Geostrophic equations.**—*I.L.D.*

11C–116 551.509.313:551.509.323:551.547

Klein, William H.; Lewis, Billy M.; Enger, Isador et al. (*all, Extended Forecast Section, U. S. W. B.*), **Application of numerical prognostic contour patterns to surface temperature forecasts.** Paper presented at the 176th National Meeting of the A.M.S. May 7, 1959, Wash., D. C. U. S. Weather Bureau, May 1959. 11 p. 7 figs. Photostat of typescript. **DWB** (M09.323 U587ap)—Multiple regression equations for predicting 5-day mean surface temperature anomalies in the U. S. from anomalies of 700 mb height have recently been developed. The required heights are approximated from daily prognostic maps prepared at the 500 mb level by a barotropic model and at the 700 mb level by a baroclinic model. The temperature forecasts resulting from the numerical prognoses are verified on independent data at 39 cities in terms of the per cent of total variance explained, and the sources of error are analyzed. Additional verification is presented in terms of temperature classes at 100 stations for forecasts prepared 3 times a week during the past six months. Comparison is made with forecasts prepared by other methods: local temperature persistence, continuity of error, and other official forecasts of the Extended Forecast Section for this year and previous years. *Subject Headings:* **1. Temperature forecasting 2. Numerical 700 mb surface forecasting. I. Crockett, Curtis W.**—*Authors' abstract.*

11C–117 551.509.323:551.509.313

Klein, W. H.; Lewis, B. M. and Crockett, C. W., **Objective forecasts of 5-day mean temperature during the fall season.** U. S. Weather Bureau, Feb. 1959. 12 typewritten p. 10 figs., 2 tables. **DWB** (M09.323 U587ob). Paper presented at meeting of American Meteorological Society in New York on Jan. 28, 1959.—A description of an objective method for predicting 5-day mean temperature during the fall season from numerical prognoses of the upper-level contour is given. The report covers the experimental work done in 39 cities of the U. S. during routine operations. From the maps and prognostic charts of the stations the upper level heights can be obtained while the surface temperatures can be gotten from the Weather Bureau district forecasts. Accuracy is to be further tested. *Subject Headings:* **1. Objective temperature forecasting 2. Numerical 5-day contour forecasting.**—*N.N.*

11C–118 551.509.53:551.509.313

†Klein, W. H.; Lewis, B. M. and Enger, I., **Objective prediction of five-day mean temperatures during winter.** *Journal of Meteorology*, Boston, 16(6):672–682, Dec. 1959. 8 figs., 2 tables, 29 refs., 6 eqs. **DWB, DLC.** Also in manuscript form. [Wash., D. C., U. S. Weather Bureau], Dec. 1958. 22 p. 15 figs., 4 tables, 31 refs. Photostat of typescript. **DWB** (M09.53 U587ob)—A statistical screening procedure is used to derive linear multiple regression equations which express 5-day mean surface temperature as a function of 5-day mean 700 mb heights centered 2 days earlier. Application of these equations to heights obtained from barotropic prognoses would have produced temperature predictions of positive skill during the test winter of 1957–58. The forecasts can be considerably improved by including as a predictor the local value of 5-day mean surface temperature for a period 4 days earlier than the forecast period. When this term was combined with the barotropically-estimated heights, objective temperature predictions comparable in accuracy to conventional forecasts were made by multiple regression equations. Further work has recently been completed to obtain additional improvement by screening the entire field of surface temperature. *Subject Headings:* **1. Objective temperature forecasting 2. Forecast accuracy 3. Multiple regression techniques.**—*Authors' abstract.*

11C–119 551.509.31

Knighting, E. (*Met. Off., Air Ministry, Dunstable, Eng.*), **The work of the Dunstable Researc Group.** *Germany. Deutscher Wetterdienst, Berichte,* 5(38):71–77, **1957.** 3 figs., 8 tables, eq German summary p. 71. **DWB, DLC**—The work at Dunstable includes the following: testing th Bushby-Sawyer model by means of time integrations. Improvements were sought by using exac time boundary conditions for the absolute height h in the 500 mb (later 600 mb) surface instead c $\partial h/\partial t = 0$ at the boundary by taking into account the nonadiabatic warming of the air, a warm se surface and introduction of a stream function in place of the geopotential at 500 mb, but these did no prove decisive advances. For the purposes of an objective analysis of the geopotential field ther was formulated an extreme condition in which the predicted values are included in addition to th observed values. The results of several numerical experiments are presented. A possible reductio of the truncation error by improved numerical approximation of vorticity and of vorticity transpor was tested by means of barotropic model calculations (over 24 hrs). An integration procedur using spherical functions was developed for the barotropic model. *Subject Headings:* **1. Numerica forecasting 2. Sawyer-Bushby model.**—*Transl. of author's abstract.*

11C–120 551.509.313:551.511.

Knighting, E.; Jones, D. E. and Hinds, Mavis K. (*all, Met. Office, Dunstable*), **Numerica experiments in the integration of the meteorological equations of motion.** *Royal Meteorologica Society, Quarterly Journal,* 84(360):91–107, April **1958.** 5 figs., 9 tables, ref., 12 eqs. **DWB, DLC**— (For abstract, *see* 10.2–152, Feb. 1959; for abstract from another source, 8F–154, June 1957, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Equations of motion.**

11C–121 551.509.31

Knighting, E., **Numerical weather forecasting.** *Weather,* London, 13(2):39–50, Feb. **1958** 4 figs. (incl. photo), 2 eqs. **DWB**—A rather thorough discussion of the theory and practice o numerical weather prediction by use of computers: the methods of formulating the problem, in tegration of the barotropic equations of geostrophic motion, introduction of refinements, objectiv analysis (machine plotting and analysis of data), errors due to grid length, time intervals and relatio of wind speeds to space-time intervals, to boundary values, to truncation errors, etc. Futur possibilities are summed up. (*Same item as* 10.8–158, Aug. 1959, *MAB.*) *Subject Heading:* **1. Nu merical forecasting.**—*M.R.*

11C–122 551.509.31

§†Komabayasi, M.; Miyakoda, K.; Aihara, M. et al. (*all, Tokyo Univ. Geoph. Inst.*), **Th quantitative forecast of precipitation with the numerical prediction method.** *Meteorological Societ of Japan, Tokyo, Journal, Ser.* 2, 33(5):205–216, Nov. **1955.** 12 figs., 20 refs., eqs. **DWB, DLC** Reprinted in *Collected Meteorological Papers,* Tokyo, 6(1/2), Dec. **1955.** Contribution No. 84.—A quantitative forecast of precipitation based on the numerical prediction method, using three laye model of the atmosphere, was made. Treating the transport of water vapor three-dimensionall and considering the temperature change, the excess of water vapor over saturation was estimated which we assumed to fall off entirely as precipitation. These calculations were performed by th graphical method designed by FJØRTOFT, using the geostrophic approximation for the wind velocity The North American Continent was chosen as the forecasting area. For a 12 hr forecast, the coin cidence between the observed and forecast precipitation was found to be fairly good, both in amoun and area. This result suggests the possibility of forecasting weather based on the large scale motio of the air. Lastly, brief discussions were given on the nonadiabatic effect, which we disregarde in our practical forecasting. (*Same item as* 9.5–123, May 1958, *MAB.*) *Subject Headings:* **1. Nu merical precipitation forecasting 2. Fjørtoft's graphical method 3. North America. I. Manabe, S II. Katow, K.**—*Authors' abstract.*

11C–123 551.509.313:551.55

Koo, Chen-chao (*Inst. of Geophysics and Met., Academia Sinica*), **Smoothing procedure i numerical analysis and forecasting realized by turbulence process.** *Acta Meteorologica Sinica* Peking, 28(4):319–323, **1957.** 9 refs., 8 eqs. In Chinese; English summary p. 322–323. **DLC**— It is pointed out in this note that the procedure of smoothing according $\phi^* = \phi + k\nabla^2\phi$, ($\nabla^2$ the finit difference Laplacian) used in numerical analysis and forecasting, after every time step, is equivalen to introducing the turbulence term with $k = A(\Delta t/\Delta s^2)$, where A is the austausch coefficient, Δt th time step and Δs the horizontal grid-size. It is also shown that the rate of damping of the wave fo different wave lengths may be estimated from

$$\phi = \sum_{m,n} \phi_{m,n} e^{-\left(\frac{1}{L_m^2}+\frac{1}{L_n^2}\right)\pi^2 A t} e^{2\pi i\left(\frac{x-ct}{L_m}+\frac{y}{L_n}\right)},$$

which is a solution of the equation

$$\frac{\partial \zeta}{\partial t} + u\frac{\partial \zeta}{\partial x} + \beta v = A\nabla^2\zeta,$$

with $\zeta = (1/f)\nabla^2\phi$. It is evident that the small scale waves damp much more rapidly than the large scale ones as the damping term involves L^{-2} in the exponential. Damping factor for 24 hr with different values of A used by different authors are computed. A proper constant value of A seems to be 5×10^9 (see tables) for $\Delta s = 300$ km and $\Delta t = 1$ hr. Richardson's result of enormous tendency is attributed to the weak smoothing with small values of austausch (2×10^8) for the scale of the motion choosen ($l \sim \Delta s = 400$ km). It is easily seen that even with Richardson's formula $A = 0.2l^{4/3}(10^2 < l < 10^6)$, the damping effect still increases with the decrease of wave length L, because in this case there is still a factor $L^{-2/3}$ in the exponential of the damping term. Therefore small scale motion is damped very effectively with the value of A given by the above formula. It is emphasized that with turbulence term the smoothing of initial data ahead by a separate program and the use of balance equation at the initial moment are not necessary; and the real instability of the inertio-gravitational wave and the false instability in computation will be no longer a serious problem. Thus the work of numerical analysis and forecasting, even with primitive equations of motion, could be carried out with more success. *Subject Headings:* **1. Numerical forecasting 2. Turbulence calculations 3. Damping (of waves).**—*Author's abstract.*

11C–124 551.509.312:551.511.2

Koo, Chen-chao, **On the simple approximate solutions for finite-difference Poisson equation.** *Acta Meteorologica Sinica*, Peking, 29(4):287–295, Nov. 1958. 6 figs., 7 refs., 24 eqs. In Chinese, English summary p. 295. **DLC**—Best approximate solutions for finite-difference Poisson equations are obtained in this paper by using a double-harmonic series solution. The first approximate solution with least square absolute error in the interval $4 \leq \lambda x/d, \lambda y/d \leq 12$ and the same with least square relative error are given. It is also proved that the nine-point formula given by BELOUSOV could be replaced by a first approximation formula with equal accuracy. It is concluded that the best solution is obtained with a formula requiring comparatively few arithmetic operations. An example of actual computation for 500 mb height tendency is included. *Subject Headings:* **1. Poisson's equations 2. Integration techniques.**—*Author's abstract.*

11C–125 551.509.313

Koo, Chen-chao, **Case study for the contribution of large-scale eddy term to height tendency.** *Acta Meteorologica Sinica*, Peking, 30(2):191–194, 1959. 7 figs., 7 refs., 3 eqs. In Chinese; English summary p. 194. **DWB**—A computation of height tendency due to large-scale eddy term is made for a ten-day period Feb. 13–22, 1956, using barotropic model. It is shown that the contribution due to the eddy transport term $\overline{v' \cdot \Delta\zeta'}$ is comparable to that due to the mean transport term $\bar{v} \cdot \Delta\bar{\zeta}$. The distribution of the height tendency due to the eddy term is rather different from that due to the mean transport term and thus they are not connected by any simple relation of proportionality. *Subject Headings:* **1. Barotropic models 2. Numerical forecasting problems.**—*Author's abstract.*

11C–126 551.509.312/3

Kusano, K., **Application of the kinematical method to the predictions of 1000 mb height and the thickness.** *Meteorological Society of Japan, Tokyo, Journal*, 36(3):118–122, June 1958. 7 figs., 5 tables, 4 refs., 7 eqs. **DWB, DLC**—A simplified method for numerical prediction of the 1000 mb height change is presented. In this method the 1000 mb height change ΔZ_0 is obtained by $\Delta Z_0 = \Delta Z_5 - \Delta h$, where the height change ΔZ_5 at 500 mb is obtained by barotropic graphical calculation, and the thickness change Δh for 500 mb–1000 mb is obtained by simple kinematical extrapolation. In connection with the forecast of Δh, we modified ESTOQUE's method. The correlation coefficients between the calculated 1000 mb height change and observed height change are 0.7~0.8, showing fairly good results. *Subject Headings:* **1. Numerical 1000 mb height change forecasting 2. Kinematic analysis 3. Correlation coefficients.**—*Author's abstract.*

11C–127 551.509.312:551.515.11

Kwizak, M., **Vorticity and cyclogenesis.** *Canada. Meteorological Div., CIR-2848, TEC-243*, Nov. 30, 1956. 12 p. 20 figs., 12 refs., eqs. **DLC**—Two synoptic case studies of major development are presented to illustrate the role of vorticity advection in sea level cyclogenesis. The theoretical basis is traced from SUTCLIFFE (1947) through PETTERSSEN (1955). The graphical method developed by FJØRTOFT (1952) is used to obtain the isopleths of "vorticity" and the advective space-mean flow. The examples indicate how vorticity advection at 500 mb is being used at the Central Analysis Office in qualitatively predicting sea-level cyclogenesis 24–36 hrs in advance. *Subject Headings:* **1. Vorticity advection 2. Cyclogenesis forecasting 3. Fjørtoft's graphical method.**—*Author's abstract.*

11C–128 551.511(02) 551.509.31

†*Laĭkhtman, D. L. and Iudin, M. I. (*eds.*), **Osnovy dinamicheskoĭ meteorologii.** [Principles o dynamic meteorology.] Leningrad, Gidrometeoizdat., **1955.** 646 p. 144 figs., 42 tables, 65 refs eqs. **DLC** (QC861.L26)—This textbook of dynamic meteorology is based upon courses taught a the University of Leningrad and at the Leningrad Hydrometeorological Institute. It is a com prehensive mathematical treatment (using differential equations rather than vector analysis) of th entire field of dynamic meteorology. Numerical forecasting is treated on p. 236–303. KIBEL' theory (published in 1940 and considered to be the first successful numerical prediction method is reviewed in detail. Current numerical forecasting models based upon dynamic theory are ther explained in sections on: 1) basic principles, 2) the vorticity equation, 3) relation between mea velocity and pressure fields, 4) linearization of the equations, 5) transformation of the velocity an pressure fields, 6) changes in surface pressure in a barotropic atmosphere, 7) dynamic equations o the atmosphere in the coordinate system x, y, p, t, 8) forecasting contour charts with the barotropic model, 9) integration by means of computers, 10) graphically and 11) baroclinic models. (Fo abstract on whole book, *see* 8.7–9, July 1957, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Dynamic meteorology textbooks.**—*I.L.D., G.T.*

11C–129 551.509.313

Levine, David A., **A report on the numerical solution of the geostrophic conservation equation** New York. University Institute of Mathematical Sciences, Contract AF 19(604)-2265, Research Report No. 1 (IMM-NYU 247), April **1958.** 24 p. 12 refs., 31 eqs. **DWB** (M551.401.4 N532sc)—A single and/or two layers of incompressible, inviscid, homogeneous atmosphere at con stant density is the model used in this theoretical discussion. The geostrophic conservation equation based on the basic equations, is from the shallow water gravity wave equations. The (UNIVAC) numerical computation indicates that the geostrophic conservation equation can be solved rapidly with accuracy. Test runs of coded information encouraged a full-scale test (in progress) of hurricane "Ione" 1955. *Subject Headings:* **1. Numerical forecasting 2. Geostrophic equations 3. Hurricane "Ione" (1955).**—*W.N.*

11C–130 551.509.58:656.

Lewis, Frank, **Minimal flight paths from forecasts of the Joint Numerical Weather Prediction Unit.** *Institute of the Aeronautical Sciences, Preprint,* No. 581, **1956.** 13 p. 4 figs., eqs. **DWB** (629.1308 I59p)—A computer program is described, which was prepared for the IBM 701 Electronic Digital Processing Machine for selecting a flight path requiring minimum flying time under forecast wind conditions as represented by a magnetic tape containing prognostic height fields. A flow chart of the 16-step program is presented and each step is explained. *Subject Headings:* **1. Minimum flight path computers 2. Minimum flight time path computations.**—*G.T.*

11C–131 551.509.313:551.571.

Lewis, William (*Joint Numerical Weather Prediction Unit, Suitland, Md.*), **Forecasting 700-mb dewpoint depression by a 3-dimensional trajectory technique.** *Monthly Weather Review,* Wash. D. C., 85(9):297–301, Sept. **1957.** 2 figs., 3 tables, 3 refs. **DWB**—Quasi 3-dimensional forecasts o 700 mb dew point depression are made for periods up to 36 hrs using observed 700 mb charts an initial and 12-hr forecast vertical motion charts from the JNWP Unit's "thermotropic model." Results show that moisture can be successfully forecast by this technique. Through establishment o a relationship between 700 mb dew point depression, instantaneous vertical velocity, and large-scal weather, a forecast scheme is devised using forecast 700 mb dew point depression and forecas vertical motion from the thermotropic model as arguments. Preliminary results of some experi mental forecasts are favorable. (*Same item as* 9.9–136, Sept. 1958, *MAB.*) *Subject Headings* **1. 700 mb dew point depression forecasting 2. Three-dimensional trajectory forecasting technique** —*Author's abstract.*

11C–132 551.509.31

Liao, Tung-hsien (*Central Inst. of Met. Res., Central W. B.*), **A simple two-layer model and it extension.** *Acta Meteorologica Sinica,* Peking, 29(3):162–175, Aug. **1958.** 3 figs., 15 refs., 54 eqs In Chinese; English summary p. 175. **DLC**—A two-layer model applicable both graphical integra tion and numerical computation is proposed. From this model the height of 500 mb surface an the thickness between a certain selected isobaric surface in the vicinity of the top of friction layer an 500 mb surface can be forecast. An extended model involving three layers is also designed. I designing them, no provision with regard to the distribution of vertical velocity is made. Finally the steadiness of space mean velocity field and the selection of lateral boundary conditions ar discussed. *Subject Headings:* **1. Numerical forecasting techniques 2. Boundary-value problems.**— *Author's abstract.*

11C–133 551.509.313:551.515.23

Magata, M. (*Met. Research Institute*). **On the truncation errors in numerical prediction.** *Papers in Meteorology and Geophysics*, Tokyo, 8(2):133–143, July **1957.** 9 figs., 2 refs., 41 eqs. **DWB**—The behavior of the truncation errors in the numerical prediction using grid points is discussed, taking into account the scale of the perturbations. When we forecast by the ordinary numerical prediction method the path of the relatively small cyclone such as the typhoon, the velocity of the center is known to become smaller than the observed value. We conclude that this fact can be explained by the behavior of truncation errors. (*Same item as* 10.8–160, Aug. 1959, *MAB.*) *Subject Headings:* **1. Truncation error 2. Numerical typhoon forecasting.**—*Author's abstract.*

11C–134 551.509.313

Maine, R. (*Div. Office, Adelaide*), **An application of one dimensional numerical forecasting in the Australian region.** *Australian Meteorological Magazine*, Melbourne, No. 17:18–36, June **1957.** 4 figs., 6 tables, 3 refs., 11 eqs. **DWB**—A five-degree grid interval for numerical integration was used in the solution of the one dimensional differential equation of motion to the equivalent barotropic model (after CHARNEY, 1949) using data in the Australian region. The forecasts along adjacent latitudes were then juxtaposed (after GATES, 1953) and a "two dimensional" forecast obtained. The "two dimensional" forecast requires considerable time for preparation and is thus uneconomical by our present standards. However, it is suggested that a one dimensional forecast along a selected latitude (say 40°S) when incorporated with the usual subjective prognostic may be used to practical advantage. (*Same item as* 9.8–131, Aug. 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. One dimensional forecasting 3. Australia.**—*Author's abstract.*

11C–135 551.509.313:551.511.33:551.513.1

Marchuk, G. I., **O termogidrodinamicheskikh protsessakh bol'shogo masshtaba v baroklinnoĭ atmosfere.** [Large-scale thermohydrodynamic processes in a baroclinic atmosphere.] *Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Trudy*, No. 2:119–141, **1948.** 7 figs., 9 refs., 88 eqs. **DLC**—In this investigation of the processes of propagation of large scale disturbances at the 1000 mb level and aloft in order to clarify the interaction of processes developing at different levels of a baroclinic atmosphere, only large processes for which quasigeostrophic wind models can be used successfully, were studied. The study deals with the questions associated with the stability of the solution of the thermohydrodynamic equations applicable to atmospheric processes. Criteria of stability of the solution of equations as a function of the waves of disturbance, variations of the Coriolis parameter with latitude and vertical slant of velocity of west-east transport were obtained. The role of factors of horizontal macroturbulence exchange in the stability of atmospheric movements was classified. Criteria of stability for solution of thermohydrodynamic equations taking into account the factors of macroturbulent exchange were obtained. The mathematical procedures of deriving and linearizing the equations, etc. are presented in detail. *Subject Headings:* **1. Numerical forecasting 2. Baroclinic models 3. Thermodynamics of the atmosphere.**—*I.L.D.*

11C–136 551.509.313:551.509.5

Martin, Donald E. (*Internat. Met. Inst., Stockholm*), **An investigation of systematic errors in the barotropic forecasts.** *Tellus*, Stockholm, 10(4):451–465, Nov. **1958.** 10 figs., 9 refs., 11 eqs. **DLC**—Forecast errors in the 24- and 48-hr barotropic 500 mb prognostic charts prepared by JNWPU for the winter of 1957 were investigated. Certain large scale forecast errors were found to persist from day to day in fairly localized geographical areas. In general, the numerical prognoses exhibited a tendency to forecast excessively high values off the southeastern coasts and excessively low values off the northwestern coasts of the continents. Little forecast error was observed in the continental interiors. A Fourier analysis revealed that the forecast errors were largely due to incorrect phase forecasts for wave numbers 1 through 4. The forecast errors associated with wave number 1 usually "positioned' the large scale systematic forecast errors near Japan and Scandinavia and contributed materially to their intensities. Relationships between forecast error fields and topography, geography, synoptic situation, and "nonadiabatic" heating are discussed. Hemispheric fields of "nonadiabatic" heating, computed by using a two-level model, are shown. Charts illustrating the dependence of "nonadiabatic" heating on the general circulation are also shown. (*Same item as* 10.7–167, July 1959, *MAB.*) *Subject Heading:* **1. Numerical forecast errors.**—*Author's abstract.*

11C–137 551.509.313:551.509.5

Mashkovich, S. A., **K uchetu effekta nelineĭnykh chlenov uravneniĭ pri reshenii zadachi o prognoze davleniia i temperatury maloĭ zablagovremennosti.** [Calculating the effect of nonlinear terms in equations for the solution of the problems of short-range forecasting of pressure and temperature.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 60:22–31, **1957.** 4 figs., 6 refs., 24 eqs. **DWB**—(For abstract, *see* 11.1–174, Jan. 1960, *MAB.*) *Subject Heading:* **1. Numerical forecast errors.**

11C–138 551.515.2:551.509.313:551.511.32

Masuda, Y. (*Met. Res. Inst., Tokyo*), **On a method for solving the balance equation in typhoon region.** *Papers in Meteorology and Geophysics*, Tokyo, 8(1):55–64, April **1957.** 9 figs., 7 refs., 23 eqs. **DWB**—In order to avoid the truncation errors near the typhoon center, which arise in the course of numerical computation, and to obtain the stream function in the vicinity of typhoon precisely, the balance equation is separated into two parts; one corresponding to the circular symmetric field and the other, to the residual field. The stream function corresponding to the circular symmetric field is easily obtained by the gradient wind equation. After the condition for existence of solutions of the balance equation corresponding to the residual field is examined, the point relaxation procedure to solve this equation is proposed. An example of this solving method, applying to typhoon "Harriet," is presented also. (*Same item as* 10.5–235, May 1959, *MAB.*) *Subject Headings:* **1. Balance equation 2. Numerical typhoon forecasting.**—*Author's abstract.*

11C–139 551.509.313:551.509.327

Masuda, Y. and Itoo, H. (*both, Met. Res. Inst., Tokyo*), **The use of a stream function for the barotropic forecast of the typhoon movement.** *Meteorological Society of Japan, Tokyo, 75th Anniversary Vol. of the Journal*, pub. Nov. **1957.** p. 296–303. 4 figs., 9 refs., 14 eqs. **DWB, DLC**—As an attempt to improve the barotropic forecast of typhoon movement, a stream function is used in this paper in place of the geopotential. The stream function in the typhoon region is obtained by solving the balance equation by MASUDA'S method. Using the stream function, the 24 hr and 36 hr forecasts of typhoon movement for 700 mb level and the 48 hr forecast for 500 mb level are performed, based on the barotropic model. The machine used for computations is the electronic computer "Fujic." In spite of insufficient boundary condition, the results of the prediction are remarkably improved. From the results we obtained, we find that our method might be useful for the practical forecast. *Subject Headings:* **1. Typhoon movement forecasting 2. Numerical typhoon forecasting.**—*Authors' abstract.*

11C–140 551.509.33:518.5

Mintz, Yale, **On heating models for extended- and long-range numerical weather forecasting and the study of the general circulation.** California. Univ. at L. A. Dept. of Meteorology, Contract AF 19(604)-1286, Scientific Report, No. 2, Nov. **1955.** 20 p. 15 refs., 4 eqs. This report also found in the **Final Report,** June 30, **1957.**—The discussion centers on the two parameter models $\dot{Q} = \dot{Q}_c + (\dot{Q}_{L1} + \dot{Q}_{L2}) + \dot{Q}R$ with $\dot{Q}$—rate of individual nonadiabatic heating, $\dot{Q}_c$—heat conduction through air-ground interface, $\dot{Q}_{L2}$ and $\dot{Q}_{L1}$—release of latent condensation heat by large scale ascent and other types of motion, $\dot{Q}_R$—rate of heating radiation (least variable). The air-ground heat transfer is the most important clue to a rational approach to the general circulation and long range numerical weather forecasts. (*Same item as* 9G–58, July 1958, *MAB.*) *Subject Headings:* **1. Heating models 2. Numerical long range forecasting 3. General circulation.**—*A.A.*

11C–141 551.509.313:551.511.3:551.543

Monin, A. S., **Izmeneniia davleniia v baroklinnoĭ atmosfere.** [Pressure changes in a baroclinic atmosphere.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz*, No. 4:497–514, April **1958. DLC**—The author reviews the fundamental ideas of contemporary theory on the variation of atmospheric pressure in a baroclinic atmosphere with a constant parameter of baroclinicity. The discussion includes the following: the equation of dynamics of the atmosphere in the quasigeostrophic approximations, the introduction of diminensionless magnitudes into the equations of the dynamics of a baroclinic atmosphere, the derivation of the equation of pressure change, the conditions of origin of rapid waves, the adaptation of pressure field to the wind field, quasigeostrophic expansion and the quasigeostrophic approximation. A number of new formulas and conclusions regarding three dimensional disturbance in the geostrophic wind field are presented. (*Same item as* 10.8–162, Aug 1959, *MAB.*) *Subject Headings:* **1. Pressure variations 2. Baroclinic models.**—*Author's summary and I.L.D.*

11C–142 551.509.327:551.509.312

Morikawa, G. K., **Geostrophic vortex motion, Pt. 2, Application to hurricane tracking.** New York. Univ. Institute of Mathematical Sciences, Contract AF 19(604)-2265, Progress Report (IMM-NYU 252), Aug. **1958.** 10 p. eqs. **DWB** (M09.327 NS32pr)—Application of the equation governing vortex motion to hurricane tracking as discussed earlier (in *IMM-NYU, Report*, No. 226 **1956**) is here demonstrated positively when the initial boundary conditions are given. Two methods are outlined, viz.: (1) the total flow method and (2) the point vortex method, of which (1) is directly applicable without losing the hurricane in the grid, and saves numerical work. Isolation of the hurricane from the rest of the flow in the numerical prediction of hurricane movement is always good. That is the merit of (2). Some test runs are discussed. *Subject Heading:* **1. Numerical hurrican forecasting.**—*W.N.*

11C–143 551.509.312:551.557.2

Murakami, T. (*Met. Res. Inst., Tokyo*), **Numerical analysis of wind and its application to the numerical weather forecasting, Pt. 1.** *Meteorological Society of Japan, Tokyo, Journal, Ser. 2.* 36(1):11–22, Feb. **1958.** 17 figs., 3 tables, 3 refs., 13 eqs. **DWB, DLC**—Divergence and relative vorticity are computed for each level at about 100 mb intervals from 950 to 300 mb by use of the observed winds. The results show that the patterns of divergence and relative vorticity are smoother than we expected. In the lower atmosphere, the maximum divergence is found slightly ahead of the cyclone in the contour field. In a broad sense, the magnitude of divergence is largest near the ground surface and weakest near 600 mb level. Numerical forecasts are attempted for the minimum divergent level, namely 600 mb level. Nonbarotropic forecasting, in which all terms in the vorticity equation are taken into consideration, is concluded to be fairly superior to the barotropic one, in which the stream function is used. This is due to the fact that, even in the minimum divergent level, the divergence term in the vorticity equation is of the same order of magnitude as the horizontal advection term. *Subject Headings:* **1. Numerical wind forecasting 2. Wind field analysis 3. Stream function.**—*Author's abstract.*

11C–144 551.509.313:551.552

Murakami, T., **Numerical analysis of wind field and its application to the numerical weather forecasting, Pt. 2.** *Meteorological Society of Japan, Tokyo, Journal, Ser.* 2, 36(3):89–96, June **1958.** 12 figs., table, 2 refs., 16 eqs. **DWB, DLC**—The effect of friction in numerical forecasting of the stream function in the lower atmosphere is considered. The stream function, as well as the velocity potential, is easily obtained by use of the observed wind. By means of the so-called divergence equation we determined the frictional coefficient, assuming, for the sake of simplicity, that it is proportional to the wind speed. In the present case, it is estimated about 4.2×10^{-5} sec^{-1}. The so-called ω-equation and the balance equation are discussed. The magnitude of the vertical velocity, obtained by the ω-equation, is about a half of that of the vertical velocity, obtained by using the observed wind. In the lower atmosphere, the stream function, which is obtained by the balance equation, is likely to overcompensate the sharpness of isobaric contour height. This fact leads to the result that near the ground surface the balance equation cannot safely be used as a first approximation of the divergence equation. *Subject Headings:* **1. Wind field analysis 2. Numerical wind forecasting 3. Stream function.**—*Author's abstract.*

11C–145 551.509.312:551.524.35:681.14:621.38

Musaelian, Sh. A. and Kheĭfets, Ia. M., **Opyt primeneniia elektronnoĭ vychislitel'noĭ mashiny "Pogoda" dlia prognoza srednemesiachnoĭ anomalii temperatury vozdukha.** [Experiment on the application of the electronic computer "Weather" for predicting the monthly mean temperature anomaly.] *Meteorologiia i Gidrologiia*, Leningrad, No. 2:3–9, **1958.** 3 figs., 4 refs., 16 eqs. **DLC.** Trans. by V. Zilius issued by American Meteorological Society under Contract AF 19(604)-1936, July **1958.** (12 p.) **DWB**—The method for forecasting numerically mean monthly temperature anomalies by means of the electronic computer "Pogoda" (Weather) is presented. This machine is capable of computing summations of the form $\sum_n \sum_m p_n{}^m q_n{}^m$. The theory of this method is based upon the work of E. N. Blinova who, viewing atmospheric motion as a disturbance imposed upon a zonal plane, linearized the equation of heat advection and obtained a new equation for nonzonal and nonstationary temperature disturbances. This equation describes the relationships between local temperature disturbances and significant elements of the atmospheric circulation, such as zonal temperature transport, etc. The general scheme of calculation with the machine is outlined, and the equations involved in the steps of preparing the initial data, computation of the Fourier coefficients, computation of coefficients for analyzing the initial field into a series of $H_n{}^m$ functions, computation of Fourier coefficients of the forecast field and the computation of the mean monthly temperature anomalies are presented. The performance of the computation by the machine is described on charts showing forecasts of mean monthly temperature anomalies, and actual mean monthly temperatures for June 1957 are presented. The forecast was made from initial data for April 19–21, 1957 and required 56 working hrs. (*Same item as* 10.5–188, May 1959, *MAB.*) *Subject Headings:* **1. Numerical temperature forecasting 2. Temperature anomaly forecasting 3. Electronic computers.**—*I.L.D*

11C–146 551.509.313

Nabeshima, Y., **On the simplified method of Fjørtoft's model for forecasting the 1000 mb surface map.** *Journal of Meteorological Research*, Tokyo, 9(7):480–484, July **1957.** 6 figs., 4 refs., 8 eqs. In Japanese; English summary p. 480. **Comments** by T. Nitta and **Reply** by Nabeshima, *Ibid.*, 10(1):81–82, **1958.** In Japanese. **DWB, DLC**—From Sept. 1956 on, we tested Estoque and Fjørtoft models twice a week, and found that Estoque's Model I is useful in case of cyclogenesis but unsatisfactory in other cases. Estoque's Model II and Fjørtoft's Model are better for daily forecasts. We simplified the Fjørtoft method, which takes only about one and half or two hrs.

It is based on the following relation

$$\frac{\partial}{\partial t}(z_0 - \tfrac{1}{2}\bar{z}_0) \frac{g}{f} J(\bar{z}_L, z_0 - \tfrac{1}{2}\bar{z}_0),$$

where z_0 and z_L are heights of the 1000 mb and the level of nondivergence respectively, and bar e presses space mean. Main assumptions in these graphical methods are as follows: wind hodograp is straight, the level of non divergence situated at 500 mb level and vertical distribution of vertic velocity is sinusoidal or parabolic. Here is shown one practical method of finding nondivergenc level available to daily routine work. *Subject Headings:* **1. Fjørtoft's graphical method 2. Estoque graphical method 3. Weather forecasting.**—*Author's abstract.*

11C–147 551.509.313:551.511

Nabeshima, Y. (*Japan Met. Agency, Japan*), **On the structure of atmosphere near the tropopaus and the numerical prediction at the 300 mb level.** *Meteorological Society of Japan, Tokyo, 75t Anniversary Vol. of the Journal*, pub. Nov. **1957.** p. 280–288. 15 figs., 2 tables, 3 refs., 10 eq **DWB, DLC**—Some attempts are made to produce prognostic charts at the 300 or 400 mb leve using the same method as we used in a previous paper. In this method the divergence term included in the vorticity equation, in order to take into account the baroclinity. The result show that the divergence term and the height of the tropopause are important because the divergenc which is derived from vertical distribution of vertical velocity is affected by abrupt change of stabilit near the tropopause. In the stratosphere, the atmosphere becomes fairly barotropic, but near th tropopause level divergence term must be considered. The correlation between the observed an calculated height changes including the divergence term is fairly better than in the case of barotropi model. *Subject Headings:* **1. Atmospheric structure 2. Numerical forecasting for 300 mb.**— *Author's abstract.*

11C–148 551.509.5:551.509.313:551.509.3

Namias, Jerome et al. (*U. S. Weather Bureau Wash., D. C.*), **Application of numerical method to extended forecasting practices in the U. S. Weather Bureau.** *Monthly Weather Review*, Wash D. C., 86(12):467–476, Dec. **1958.** 11 figs., table, 9 refs. **DWB, DLC**—New procedures are de scribed for applying numerical methods to extended forecasting. These form a firm base whic serves as a point of departure for the final forecast. The methods are sufficiently organized tha training and actual forecasting are speeded up and the level of skill of prediction is higher than ev before. *Subject Headings:* **1. Numerical 5-day forecasting techniques 2. Extended forecast ver fication. I. U. S. Weather Bureau. Extended Forecast Section.**—*Authors' abstract.*

11C–149 551.509.313:551.509.2

Nemchinov, S. V., **Kratkosrochnyĭ prognoz nezonal'nykh otkloneniĭ vysot absoliutnoĭ topogra dlia nizhneĭ i sredneĭ troposfery.** [Short-range forecast of non-zonal deviations of absolute isobar surfaces for the lower and middle troposphere.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz* No. 6:752–764, June **1958.** 8 figs., table, 9 refs., eqs. **DLC.** English transl. in the **Izvestii** *Bulletin of the Academy of Sciences of the USSR, Geophysics Series*, No. 6, June **1958,** issued 19 by the American Geophysical Union.—A linearized system of equations of thermohydrodynamics solved in a quasigeostrophic approximation by taking into account stratification and the fundament elements of the baroclinic model of the atmosphere. This system of equations is written in the for

$$\frac{\partial \Delta Z}{\partial t} + \frac{g}{l}\left(\frac{\partial Z}{\partial x}\frac{\partial \Delta Z}{\partial y} - \frac{\partial Z}{\partial y}\frac{\partial \Delta Z}{\partial x}\right) + \frac{\beta \partial Z}{\partial x} = \frac{l^2}{g}\frac{\partial \tau}{\partial p}$$

$$\frac{\partial T}{\partial t} + \frac{g}{l}\left(\frac{\partial Z}{\partial x}\frac{\partial T}{\partial y} - \frac{\partial Z}{\partial y}\frac{\partial T}{\partial x}\right) = \frac{RT(\gamma_a - \gamma)}{gp}\tau$$

$$\frac{\partial Z}{\partial p} = -\frac{RT}{gp}$$

with limiting conditions $\tau = 0$, when $p = 0$; $\tau = gp_0(\partial Z/\partial T)$ when $p = P_0$ and initial data when $t =$ $Z = Z(x,y,p,0) =$known functions. Here $p =$pressure; $\tau = dp/dt$; $T =$temperature, p_0 and $P_0 =$surfa density and pressure; $R =$constant; $\gamma_a =$adiabatic vertical temperature gradient; $\gamma =$vertical te perature gradient; $\Delta = (\partial^2/\partial x^2) + (\partial^2/\partial y^2)$. The linearization of these equations is carried out a equations for non-zonal deviations of the heights of absolute topography are derived and the solution in the lower and mean troposphere is used to forecast 24 hours in advance the 1000 m surface pressure field in the atmosphere. *Subject Headings:* **1. Short range forecasting 2. Numeric forecasting 3. Prognostic charts.**—*Author's summary and I.L.D.*

11C–150 551.509.313:551.509.5

Obukhov, A. M., **O tochnosti predvychisleniia advektivnykh izmenenii polei pri chislennom prognoze pogody.** [Accuracy of precalculated advective field changes in numerical weather forecasting.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz.*, 9:1133–1141, **1957.** 2 figs., 11 refs., 9+ eqs. **DWB.** Trans. into English by A. Nurklik issued as *Canada. Meteorological Branch, Meteorological Transactions*, No. 1:20–29, Jan. **1959.**—The nature of the errors involved in numerical forecasting of pressure fields is summarized briefly. In this study the author examines only the errors associated with the replacement of spatial derivatives along coordinates by corresponding finite differences, using the simplest model in which the changes in field have an advective character. For the sake of simplicity it is assumed that a certain magnitude—S (temperature, pressure field, etc.) is determined on an infinite straight line, $\infty < x < +\infty$, but in the case of numerical solution it is given in the intersections of an exact grid $x_k = kh$, where h—magnitude of a space of the grid and k is any whole number. The equation $\frac{\partial S}{\partial t} = -U\frac{\partial S}{\partial x}$ solved on the form of the corresponding differential difference equation $\frac{\partial S_k}{\partial t} = \frac{U}{2h}(S_{k-1} - S_{k+1})$ for the initial condition $S_k(0) = F(x_k)$. The solution of the difference equation in the general form and for the specific example of a "moving front" is presented and the magnitude and nature of the corresponding errors are explained with the aid of graphs. Also the problem of the introduction of smoothed fields into the computation operation is discussed. (*Same item as* 10.8–163, Aug. 1959, *MAB.*) *Subject Heading:* **1. Numerical forecast errors.**—*Author's summary and I.L.D.*

11C–151 551.509.313

Ogura, Yoshimitsu (*Johns Hopkins Univ.*), **On the truncation error which arises from the use of finite differences in the Laplacian operator.** *Journal of Meteorology*, Boston, 15(5):475–480, Oct. **1958.** 3 figs., table, 4 refs., 21 eqs. **DWB, DLC**—The modification of the power spectrum for the Laplacian of a variable, associated with the use of finite differences instead of derivatives, is discussed for an isotropic scalar field. The results permit one to specify a finite difference scheme which reduces considerably the systematic truncation error in the Laplacian operator. (*Same item as* 10.8–164, Aug. 1959, *MAB.*) *Subject Heading:* **1. Truncation error.**—*Author's abstract.*

11C–152 551.509.313:551.511

Palmieri, Sabino, **Sulla preparazione di topografie a 500 mb, previste per 48 ore, mediante integrazioni grafiche.** [Preparation of 500 mb prognostic contour charts for 48 hours, by means of graphical integration.] *Rivista di Meteorologia Aeronautica*, Rome, 18(4):3–11, Oct./Dec. **1958.** 5 figs., table, 5 refs., 12 eqs. French, English and German summaries p. 3. **DWB**—The results of a set of prognostic charts prepared by the FJØRTOFT-ESTOQUE method are analyzed. A systematic defect in the advection field is pointed out and a slight change in the smoothing process, giving better results, is suggested. (*Same item as* 11.1–169, Jan. 1960, *MAB.*) *Subject Headings:* **1. Fjørtoft's graphical method 2. Graphical forecasting models.**—*Author's abstract.*

11C–153 551.509.313:551.511.32:551.513.1

†Pfeffer, Richard L. (*Geophysics Res. Directorate*), **On the design of a numerical experiment for the study of the general circulation of the atmosphere.** (In: Massachusetts Institute of Technology. Dept. of Meteorology, Contract AF 19(604)-1000, **Final Report,** Dec. 31, **1957.** p. 414–449. 3 figs., 22 refs., 50 eqs.) **DWB**—A two parameter quasi-geostrophic model is derived, which incorporates effects of differential heating and friction as well as the vertical advection of vorticity and the turning of the vortex tubes from the horizontal into the vertical. A spherical coordinate system, with pressure as the vertical coordinate, is used in the derivation, and the model is applied over the Northern Hemisphere from 15°N to 80°N lat. The two parameters used to describe the flow are the geopotential height of the 700 mb and 200 mb surfaces. The resulting model can be used as a basis for conducting "controlled" numerical experiments (much like the physical experiments of FULTZ) in which each of the external parameters (e.g. heating, rotation, viscosity) is varied in a specified manner in order to determine how this general circulation of the atmosphere would react to a variety of natural and artificial stimuli. The design of the first in a series of such experiments is discussed. (*Same item as* 10.9–185, Sept. 1959, *MAB.*) *Subject Headings:* **1. General circulation studies 2. Numerical forecasting models. I. Massachusetts Inst. of Technology, Dept. of Meteorology II. Contract AF 19(604)-1000.**—*Author's abstract.*

11C–154 551.509.313:551.557:551.509.5

Phillips, Norman A. (*Mass. Inst. of Technology*), **Geostrophic errors in predicting the Appalachian storm of Nov. 1950.** *Geophysica*, Helsinki, 6(3/4):389–405, **1958.** 7 figs., 11 refs., 19 eqs. **DWB, DLC**—A 2-level stream function model is used for a forecast of the Appalachian storm of Nov. 24,

1950. The development is correctly predicted except for some underestimate of the surface intensit The large errors found in previous geostrophic forecasts of this storm are explained by the exce of the geostrophic over the true wind speed in the upper level trough, and its effect on the horizont advection of vorticity at upper levels. The release of latent heat seems to be important for t final intensity, but probably not the occurrence, of this case of cyclogenesis. *Subject Headin* **1. Geostrophic wind errors 2. Numerical forecasting errors.**—*Author's abstract.*

11C–155 551.511.3:551.509.3

Phillips, Norman A., **On the problem of initial data for the primitive equations.** *Massachuse Institute of Technology, Dept. of Meteorology, Numerical Weather Prediction Project Technical Repo* (Unnumbered), Sept. **1959.** 19 p. 11 refs., 33 eqs. "Research sponsored under Contract No 1841(18)."—It is first demonstrated that in a forecast with the primitive equations, pure geostroph or purely nondivergent initial wind fields will result in noticeable meteorological "noise," especial in a baroclinic atmosphere. It is then shown in a linear example that this noise is greatly suppresse if the divergence of the initial wind field is set equal to the divergence implied by the usual geostroph theory of numerical weather prediction. The absence of noise in CHARNEY's 1955 test computatio with nondivergent "balanced" initial data is explained. Finally, the quasigeostrophic expansion used to define initial data for a nonlinear forecast with the primitive equations. Two cases a considered, that where only the geopotential is known from observations, and that where only t nondivergent part of the wind is known from observation. It is shown that the initial tendenci computed from initial data of this kind preserve the assumed geostrophic character of the flow, a thereby make it possible to get more accurate forecasts with the primitive equations. *Subje Headings:* **1. Numerical forecasting problems 2. Data requirements in forecasting.**—*Autho abstract.*

11C–156 551.509.58:551.515.

Piatygina, K. V. and Zakharova, M. N., **Predvychislenie peremeshchenií tsentrov tsiklono** [Precalculation of the movement of cyclone centers.] *Leningrad. Glavnaia Geofizicheskaia O servatoriia, Trudy*, No. 71:49–65, **1957.** 4 figs., 6 tables, 3 refs., 30 eqs. **DWB** (M(055) U581tG)– The fundamental concept of the method of forecasting the trajectories of pressure centers on t basis of the general equations of atmospheric dynamics, developed by M. I. IUDIN, is examined a its application to forecasting the displacement of surface pressure centers is illustrated. The deriv tion of formulas suitable for calculating the trajectories on an electronic computer is carried ou The trajectories were calculated for a triangular and rectangular grid. The deviations of the foreca trajectories from the actual are the same with respect to direction but is 35% less for the triangul grid in regards to velocity. For the triangular grid, the deviation of the actual from the real t jectory of pressure centers from the forecast trajectories is diminished if the deviations from t geostrophic wind are computed from the initial data for three or four levels rather than for tw The results of individual forecasts for cyclone movement are presented. *Subject Headings:* **1. Cyclo movement forecasting 2. Trajectory forecasting.**—*I.L.D.*

11C–157 551.509.313:551.5

Pichler, H., **Zur graphischen Integration der barotropen Wirbelgleichung nach Fjørtoft im 8 mb-Niveau.** [Graphical integration of the barotropic vorticity equations for the 850 mb level the Fjørtoft method.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, Vienn 11(2):218–226, **1959.** 4 figs., 6 refs., 8 eqs. German, English and French summaries p. 218. **DW DLC**—An attempt has been made to carry out the graphical integration of the barotropic vortici equation of FJØRTOFT in the 850 mb level. By the example of a characteristic weather situation t approximative formulas given by FJØRTOFT are examined and the results of the discussion co municated. *Subject Headings:* **1. Fjørtoft's graphical method 2. Barotropic vorticity equations.** *Author's abstract.*

11C–158 551.509.313:551.511:551.513

Platzman, George W. and Baer, Ferdinand, **Extended numerical integration of a simple bar tropic model, Pt. 1, Program.** Chicago Univ. Dept. of Meteorology, Grant NSF-G2159, Technic Report, No. 1, April **1958.** 49 p. figs., tables, 2 refs., eqs. **Pt. 2, Results.** *Ibid.*, Technic Report No. 3, Dec. **1958.** 89 p. figs., tables, 13 refs., eqs. **DWB** (M13.1 C532te)—Numeric computations on the integration of a simple barotropic model were made and are presented in Pt. of this report. Pt. 2 is a continuation of that investigation which aimed at studying not only t behavior of the models in relation to FJØRTOFT's theory and of the nonlinear periodicities, but al on the study of the truncation errors. This paper gives the results of the investigation. It is not that the total energy fluctuation, the total vorticity time variations, the stream function analys and the smoothing technique used in the study of the nonlinear periodicities have reduced the trunc tion errors. The results of the computation are within the limits set by an approximate form of t

ØRTOFT theory. Several curves illustrating the mean flow and the energy in harmonic components ... plotted. *Subject Headings:* **1. Barotropic models 2. Numerical forecasting 3. Fjørtoft's ...iphical method.**—*N.N.*

11C–159 551.509.313:551.511.32

Platzman, G. W. (*Univ. of Chicago*), **The lattice structure of the finite-difference primitive and ...rticity equations.** *Monthly Weather Review*, Wash., D. C., 86(8):285–292, Aug. **1958.** 4 figs., ...refs., 6 eqs. **DWB, DLC**—The use of central differences on a rectangular net, in solving the ...imitive or vorticity equations, produces solutions on each of two lattices. By exploring this lattice ...ucture, a formal equivalence is established between the central-difference vorticity and primitive ...uations. A demonstration is given also that exponential instability, previously found to result ...m certain types of boundary conditions, is suppressed by applying these conditions in such a way ... to avoid coupling the lattices. (*Same item as* 10.8–165, Aug. 1959, *MAB.*) *Subject Headings:* **Vorticity equations 2. Numerical forecasting techniques.**—*Author's abstract.*

11C–160 551.509.313:551.511.32

Platzman, G. W., **The spectral form of the vorticity equation.** Chic. Univ. Dept. of Meteor...ogy, Grant NSF-G2159, Technical Report No. 5, June **1959.** 51 p. 17 refs., eqs. **DWB** (M13.1 ...532te)—The nonlinear aspects of the vorticity equation for two-dimensional planetary circulations ... the earth's atmosphere may be studied by expansion of the solution in spherical surface harmonics. ...me of the main mathematical problems are discussed here, that arise in an examination of the ...spectral" form of the vorticity equation, which results from such an expansion. The truncation ... the spectral equations is discussed, and a proof is given of the invariance of mean square velocity ...d vorticity for truncated spectra. Some comments are made on low-order systems, which are ...o be followed by a detailed investigation of three-component systems in the second part of this study. *...ubject Headings:* 1. **Numerical forecasting 2. Vorticity equations.**—*Author's abstract.*

11C–161 551.509.312:621.389:681.142

Pône, Robert and Dady, Guy, **Prévision du temps et calcul électronique.** [Weather forecasting ...nd electronic calculation.] *France. Secrétariat Général à l'Aviation Civile et Commerciale. Bulletin ...e Liaison et de Documentation.* No. 94:26–28, Jan. 15, **1958. DLC**—Comments on the introduction, ...t the French Meteorological Service, of an electronic computer which may provide a means for ...aking numerical quantitative forecasts of atmospheric evolution. For a first attempt, only the ...arotropic model with observations of the altitude of the 500 mb surface will be used. *Subject ...eadings:* **1. Numerical forecasting 2. Electronic computers.**—*A.V.*

11C–162 551.509.313:681.4:621.38

Potievskiĭ, N. M., **Elektronnaia vychislitel'naia mashina "Pogoda."** [The electronic computer ...Pogoda" (Weather).] *Meteorologiia i Gidrologiia*, Leningrad, No. 8:51–57, Aug. **1958.** 6 figs. ...incl. photos), 3 eqs. **DWB, DLC**—The "Pogoda," used by the Central Forecasting Institute, is a ...pecialized electronic numerical computer designed for solving problems that can be reduced to ...alculating the sums of pairs of products. The problems that can be solved include the resolution ...f functions into series and sums of series; calculation of the value of a polynomial solution of systems ...f linear equations of higher orders, etc. The characteristic problem of the class of the sum of pair ...roducts is that of the multiplication of a matrix. The form of representing the numbers in the ...nachine is that of a fixed command before the principal class. The numbers and results of calcula...ion may have two ranges of values of decimal numbers. The numbers on the perforated tape are ...ntroduced simultaneously in two groups; one serving for a binary system of calculation and the other ...both for a binary and a binary-decimal system. The system of computation on the machine is ...binary. The machine operates at a rate of 200 operations per min. and it has a system of 14 com...mands, each consisting of a specific number. The machine has 400 electron tubes, numerous semi...conductors, etc. It consists of three counters with a control desk and five special tables upon which ...the electromechanical part is mounted. The counters contain the electronic part of the machine ...which consists of 600 cells. In preparing a problem for solution it is reduced to a multiplier and ...multiplicand which, together with the command, are put on perforated tape. The operations of ...putting the numbers and command on tape, the insertion of the tape into the machine, the elimination ...of possible errors, the movement of the numerical material in the machine, and the method of solving ...a typical problem, such as the multiplication of two matrices, are described. Illustrations of the ...various parts of the computer and a block diagram are presented. *Subject Headings:* **1. Electronic computers 2. Pogoda computer.**—*I.L.D.*

11C–163 551.511.33:551.509.312/313(98)

Reed, Richard J., **Dynamical predictions for the Arctic: summer season.** Washington (State). ...Univ. Dept. of Meteorology and Climatology, Contract AF 19(604)-3063, Scientific Report No. 4;

Occasional Report No. 12, April **1959.** 52 p. 19 figs., 6 tables, 7 refs., 3 eqs. **DWB**—Forecas of 1000 mb and 500 mb heights were prepared for the Arctic for a 20-day period in July, 1956. T forecasts were based on a two-level baroclinic model; solutions were obtained by both graphical a combined graphical and numerical integrations. The day-to-day performance of the method, revealed by correlations between predicted and observed heights and root-mean-square-errors, w slightly better than for a similar Arctic series reported on by ESTOQUE and somewhat worse than f comparable forecasts at middle latitudes. From the geographical distribution of correlations a errors, little evidence of important topographical influence was found. In general, the performan was best in regions where the synoptic activity was most pronounced. Since greatest activi occurred in a region of sparse data north of Siberia and Alaska, there was little relationship betwe the density of observations and the accuracy of the forecasts. In explaining the differences betwe the results of this and other studies, it is necessary to take both the synoptic activity and the qualit of the analyses into account. The combined graphical and numerical integrations verified wor at both 1000 mb and 500 mb than the cruder and supposedly less accurate graphical integratio Thickness forecasts computed from the combined method were superior to those derived by the mo approximate technique. The reasons for these contradictory results are not clear. From a stud of the algebraic mean thickness error, there appeared to be some evidence of nonadiabatic heati over continental regions and of cooling over oceanic areas. The magnitudes were too small seriously affect the forecasts. An investigation of the behavior of vorticity features revealed th the underlying conservation principle was not too well obeyed, and that both the nonconservativene and the large time interval employed in the integration contributed to the observed errors. Ge erally speaking, the results confirm ESTOQUE's conclusion that reasonably successful predictio should be possible in the Arctic by dynamical methods once the data network is improved. Ev with the present network, useful results are obtained on a considerable number of occasions. *Subje Headings:* **1. Numerical forecasting for Arctic 2. Arctic weather forecasting.**—*Author's abstract.*

11C–164 551.509.313:551.515.

Reiser, Heinz (*Numerical Weather Prediction Project, Deutscher Wetterdienst, Frankfurt*), **On th influence of static stability on the development of disturbances.** Germany. Deutscher Wette dienst, Contract AF 61(514)-735-C, Technical Note, No. 3A, **1956.** 25 p. 11 figs., 5 refs., 16 eq Also in its Technical (Final) Report, June 30, **1957,** Sec. 0 (24 p.). German version: **Über de Einfluss der statischen Stabilität auf die Entwicklung von Störungen.** *Meteorologische Rundscha* 9(7/8):113–120, July/Aug. **1956.** 12 figs., 5 refs., 16 eqs. **DWB**—For abstract *see* 7.11–176, No 1956, *MAB. Subject Headings:* **1. Numerical forecasting 2. Cyclone development.**

11C–165 551.509.3

Reiser, H., **Über das Verhalten der Verfahrens- und Abrundungsfehler bei der numerische Integration der barotropen Vorticitygleichung.** [Behavior of truncation and smoothing errors numerical integration of the barotropic vorticity equation.] *Frankfurt a.M. Universität. Meteor logisch-Geophysikalisches Institut, Berichte,* No. 6:69–72, **1956.** 8 eqs. **DWB**—(For abstract, s 10.8–166, Aug. 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting techniques 2. Truncatio error.**

11C–166 551.509.313:551.551

Reiser, H., **On the inclusion of friction in the methods of numerical weather prediction.** Ge many. Deutscher Wetterdienst, Contract AF 61(514)-735 C, Technical (Final) Report, June 3 **1957.** Sec. P (47 p.) 11 figs., 6 refs., numerous eqs. **DWB** (M09.312 G37st)—Starting from simple model of atmospheric friction ($R' = -\lambda v$, where R' refers to the unit mass, λ is a functi depending on height and pressure, and v is the speed of the mass of air), and including simplifi expressions of turbulent friction, the author develops a mathematical treatment of a modificati of geostrophic equations to take account of lower boundary conditions. (*Same item as* 10.8–16 Aug. 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Turbulent friction.**—*G.T.*

11C–167 551.509.3

Reiser, H., **Über die numerische Berechnung zukünftiger atmosphärischer Zustände.** [N merical calculation of future atmospheric conditions.] *Germany. Deutscher Wetterdienst, Berich* 5(38):81, **1957.** (Abstract only.) **DWB, DLC**—Owing to the nonlinearity of atmospheric mo equations, which as a whole can be solved only by numerical methods, it is difficult to estima realistically the truncation and rounding off errors; such estimates can be made easily in the case linearized equations. The estimation of these errors was investigated by using a quasigeostroph 2-level model. The linearized model equations form simple wave solutions by means of which t general initial problem can be solved by superposition. The solutions are carried out for analy equations and for differential equations; from a comparison of both solutions, it is possible to consi the behavior of the truncation error which the phase velocities of individual partial waves modi

evaluation of the uncertainty realm arising through estimation error shows that in baroclinic stable partial waves this error can increase with the same exponential functions as the wave itself. the case of real phase velocities, the error increases more slowly as N^2 when N is the number of ne steps. This phase difference between partial waves of the analytic model and that of the ference equation resulting from the truncation errors increases linearly with time and very rapidly th diminishing wave length. (*Same item as* 10.8–168, Aug. 1959, *MAB.*) *Subject Headings:* **Numerical forecasting 2. Truncation error.**—*I.L.D.*

11C–168 551.509.313

Reuter, H., **Zum gegenwärtigen Stand der numerischen Wettervorhersage.** [Present state of umerical weather forecasting.] *Österreichisches Ingenieur-Archiv*, Vienna, 10(2/3):252–260, **1956.** refs., 15 eqs. **DLC**—A mathematical formulation of the present knowledge as well as unsolved oblems of numerical forecasting. In particular, the "filter condition" is examined as an implement the differential equations employed in the prognostications. It is found that the major problem overcome in numerical forecasting is to replace the geostrophic approximation by some other ter condition. *Subject Headings:* **1. Numerical forecasting 2. Geostrophic approximation.**—*W.N.*

11C–169 551.557:551.542.1

Sadokov, V. P. and Dobryshman, E. M., **O reshenii uravneniia, opisyvaiushchego vozmuicheniia v pole gradientnogo vetra.** [Solution of equations describing the perturbations in a gradient ind field.] *Moscow. Tsentral'nyi Institut Prognozov, Trudy*, No. 43(70):34–48, **1956.** 4 refs., 3 eqs. **DWB, DLC**—(For abstract, *see* 10.9–234, Sept. 1959, *MAB.*) *Subject Heading:* **1. Gradient ind perturbations.**

11C–170 551.509.313:551.515.8

Sadokov, V. P., **K uchetu vliianiia frontal'nykh razdelov pri kratkosrochnom prognoze davleniia vertikal'nykh skorostei.** [Calculating the influence of frontal discontinuities in short range precasting of pressure and vertical velocities.] *Moscow. Tsentral'nyĭ Institut Prognozov, Trudy*, No. 60:17–21, 1957. 4+1 figs., 3 refs., 19 eqs. **DWB, DLC**—The problem of frontal discontinuities n short range forecasting is solved by regarding the atmosphere as a double layer fluid, of which each layer corresponds to a warm or cold air mass. (For a fuller abstract, *see* 10.9–152, Sept. 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Frontal effects in numerical forecasting . Short range forecasting.**

11C–171 551.509.52:551.557

Saucier, Walter J., **Error analysis of geostrophic 300-mb numerical windspeed forecasts.** *U. S. Air Weather Service, AWS Technical Report*, 105–148, Sept. **1958.** 2 p. 2 figs. **DWB** (M(055) J58a)—A brief verification study is made of the eight sets of forecast and verification data obtained by the Detachment 2 of Headquarters Air Weather Service during July 28 to Aug. 1 and Aug. 4–8, 1958. The forecast speed errors are accounted for in this report. The systematic error in the wind speed forecast was small and positive, being −0.6 knots at 85°N, +1.2 at 75°N, +0.8 at65°N, +2.2 at 55°N, +0.4 at 45°N, and +0.4 at 35°N. These results represent summertime conditions. Winter speed errors might be different. *Subject Headings:* **1. Numerical forecast verification 2. Numerical wind speed forecasts.**—*N.N.*

11C–172 551.509.313:551.509.311

Sawyer, J. S. (*Meteorological Office, Dunstable*), **Two-parameter techniques of numerical forecasting applied to a small intense depression.** *Great Britain. Meteorological Research Committee, M.R.P.* 1063, Aug. 26, **1957.** 6 p. 3 figs., 6 refs., 3 eqs. **DWB** (M(055) G786m)—In order to evaluate the usefulness of the SAWYER-BUSHBY two-parameter model in forecasting the deepening of small depressions, the author introduced minor changes into the model and applied it, with satisfactory results to such a depression which occurred over the British Isles on July 28–29, 1956. It is pointed out, however, that the success of the modified equation depends on a correct decision on where to use it (instead of the original equation) and accurate assumption of initial conditions. Nevertheless, if further developed, the modified model may prove to meet the needs of the forecaster whose concern is with the development of medium-scale systems within 24 hrs. *Subject Headings:* **1. Numerical forecasting 2. Two-parameter models 3. Barometric depressions 4. British Isles.** —*G.T.*

11C–173 551.509.313:551.551:551.558.21 551.511.3

†Sawyer, J. S., **The introduction of the effects of topography into methods of numerical forecasting.** *Royal Meteorological Society, Quarterly Journal*, 85(363):31–43, Jan. **1959.** fig., 2 tables, 24 refs., 18 eqs. **DWB, DLC**—The experience of weather forecasters makes it clear that mountain barriers have important effects on the movement and development of depressions and anticyclones.

The distribution of land and sea also appears to modify the tracks of depressions. It is importa therefore, that the effects of topographic features should be incorporated in the models used a basis for numerical weather prediction so far as this is possible. However, the dynamical mechanis by which hills and mountains influence the large scale weather systems are not yet fully understoo and it is the purpose of the present paper to survey the mechanisms most probably involved, assess their relative importance and to indicate the manner in which appropriate modifications mig be made to the quasigeostrophic models of numerical forecasting. The motions which are set up an airstream as it crosses a mountainous area are not solely, or even primarily, on the horizon scale which is treated by the equations used in numerical weather prediction, but it cannot be assum that the smaller-scale motions have no effect on the behavior of the large-scale systems for whi predictions are to be made by numerical forecasting. The motions which are caused directly topography can be classified broadly as follows: (a) Small-scale turbulent motion mainly in the low troposphere; (b) Gravity oscillations which may extend upwards as far as the stratosphere; (c) Osc lations about geostrophic equilibrium; (d) Quasigeostrophic motions. The smaller-scale motio (a) and (b), dissipate energy and act as a resistance to the larger-scale motion. Only the qua geostrophic motions (d) can be adequately treated by the equations which currently form the ba of numerical weather prediction, and even here there is a serious difficulty because the two-paramet model atmosphere, which is a convenient basis for computation, assumes a vertical distribution of t amplitude of the disturbance which is appropriate to depressions and anticyclones, but which may n necessarily be appropriate to orographically-induced disturbances. The four scales of motion a considered in this paper. (*Same item as* 10.7–168, July 1959, *MAB.*) *Subject Headings:* **1. N merical models including topographic effect 2. Topographic effects on numerical forecasting.** *Author's introduction.*

11C–174 551.509.312:551.557:551.542

Shuman, Frederick G. (*Joint Num. Wea. Prediction Unit, Suitland, Md.*), **Predictive cons quences of certain physical inconsistencies in the geostrophic barotropic model.** *Monthly Weath Review*, Wash., D. C., 85(7):229–234, July **1957.** 7 figs., 8 refs.; 14 eqs. **DWB, DLC**—The physic inconsistency of geostrophic flow and small surface pressure tendencies is discussed. The frequent disastrous consequences in conventional geostrophic barotropic predictions are numerically identifi by comparisons with experimental "semigeostrophic" barotropic predictions from which the i consistency has been removed. Effects of the inconsistency of the geostrophic wind field with t equations of motion are also quantitatively isolated by comparisons of semigeostrophic predictio with predictions made with wind fields which satisfy the balance equation. It is concluded that t principal fault of the conventional geostrophic approximation lies in the violation of the continui equation. Its lack of the dynamic effects expressed in the equations of motion seems also significa but is less important. (*Same item as* 10.3–163, March 1959, *MAB.*) *Subject Headings:* **1. Ge strophic approximation 2. Barotropic tendency computation 3. Geostrophic wind field.**—*Autho abstract.*

11C–175 551.509.312:551.501.

Shuman, F. G., **Numerical methods in weather prediction, Pt. 1, The balance equatio** *Monthly Weather Review*, Wash., D. C., 85(10):329–332, Oct. **1957.** 7 refs., 11 eqs. Also: **Pt. Smoothing and filtering.** *Ibid.*, 85(11):357–361, Nov. **1957.** 6 figs., 2 refs., 9 eqs. **DWB, DLC** Two methods of solving the balance equation are outlined in the first paper. Both methods ha been used successfully on a daily operational basis at the Joint Numerical Weather Prediction U for a period of more than a year. Solutions were on the operational grid of 30×34 points spaced 381-km intervals. In the second paper, a method is developed for the design of finite-differer smoothing and filtering operators which meet predetermined specifications, and which are applica to automatic computing machinery. The general technique is to build complicated operators fr the simplest types. The necessity for smoothing predicted fields of stream functions before inverti the balance equation for heights of isobaric surfaces is brought out. (*Same item as* 9.8–129, A 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Balance equation 3. Smoothing a filtering.**—*Author's abstracts.*

11C–176 551.509.312:551.501.

Sigtryggsson, Hlynur and Wiin-Nielsen, Aksel (*both, Internat. Met. Inst., Stockholm*), **Expe ments in numerical forecasting, using space-smoothed fields.** *Tellus*, Stockholm, 9(3):296–3 Aug. **1957.** 9 figs., 6 tables, 8 refs., 37 eqs. **DWB, DLC**—A number of experiments in numeri forecasting, using a technique based on the theory developed by FJØRTOFT, have been perform Sec. A contains the results of making barotropic 500 mb forecasts for 24 and 48 hrs where the vortic is advected in a space-smoothed field held constant in 12 or 24 hrs. The results indicate that forecasts in the mean are slightly less accurate as measured by the correlation coefficient betwe computed and observed changes. It is pointed out that the root mean square of the compu

nges is smaller than for ordinary barotropic forecasts, especially for a large area. Sec. B contains results of an experiment to forecast the thickness field between 1000 and 500 mb. The forecasts based on the theory developed by FJØRTOFT (1955). The flow at 500 mb has, however, in these ecasts been forecast with the barotropic model. The errors in these forecasts are of the same ler of magnitude as in the barotropic forecasts. In the last part, an attempt is made to relate the ors to physical defects of the model, especially the assumption of adiabatic motion. (*Same item as* –134, Sept. 1958, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Space-smoothing hniques 3. Fjørtoft's graphical method.**—*Authors' abstract.*

11C–177 551.509.313:551.509.324:551.511.13

Smagorinsky, Joseph (*Acting Chief, Cir. Res. Sec., U. S. W. B.*), **On the inclusion of moist iabatic processes in numerical prediction models.** *Germany. Deutscher Wetterdienst, Berichte,* 38):82–90, **1957.** 7 figs., 5 refs., 41 eqs. English and German summaries p. 82. **DWB, DLC**—e use of the dry-adiabatic, quasi-linearized 3-level barotropic model to predict large scale averaged ecipitation does not lead to successful results even when convective precipitation is taken into count. The discrepancy is attributed mainly to the result of incorrect vertical motions inherent baroclinic models. Also in addition to convective activity the neglect of the feed-back and heat of ndensation and the linearization of the static stability could account for a considerable part of the screpancy between predicted and large scale observed precipitation. It is postulated that the at of condensation has an important destabilizing influence which manifests immediately in rtical motions. Accordingly, equations are derived for a 3-level moist adiabatic model and the eans of solution and the results of controlled experiments from which the above hypothesis was duced are presented. (*Same item as* 10.9–153, Sept. 1959, *MAB.*) *Subject Headings:* **1. Numerical recasting 2. Adiabatic processes.**—*I.L.D. and author's summary.*

11C–178 551.509.313

Smagorinsky, J., **On the numerical integration of the primitive equations of motion for baroclinic ow in a closed region.** *Monthly Weather Review,* Wash., D. C., 86(12):457–466, Dec. **1958.** table, refs., 88 eqs. **DWB, DLC**—This paper considers the problem of numerically integrating the imitive equations corresponding to a 2-level model of the atmosphere bounded by two zonal walls a spherical earth. Inertio-gravitational motions of the external type are filtered a priori; for such constraint it is possible to define a stream function corresponding to the vertically integrated otions. A system of integration is developed for initial conditions which specify the shear wind ector, the specific volume, and the vorticity of the vertically integrated flow. Methods for reducing uncation error and for increasing the rate of convergence of the elliptic part are discussed. The uestion of boundary conditions is discussed at length. It is shown that the usual central difference ethods yield independent solutions at alternate points, thus providing a source of computational stability to which the primitive equations are particularly sensitive. The solutions may be made ompatible by suitable computational boundary conditions which can be deduced as sufficient onditions for insuring that the numerical solutions possess exact integrals. The application of hese considerations to viscous flow is also discussed. *Subject Headings:* **1. Equations of motion . Integration techniques 3. Truncation error 4. Boundary-value problems.**—*Author's abstract.*

11C–179 551.552:551.542.1 551.509.313

Solberg, H., **On the relation between pressure field and paths of moving air particles.** *Meteorologiske Annaler,* Oslo, 4(5):55–86, **1956.** 4 refs., numerous eqs. **DLC**—General criteria for the deviation of the actual wind from the geostrophic wind are presented, keeping in mind possible pplications to numerical forecasting. The acceleration leading to these deviations is first assumed o be a linear function of the time, then more general cases are treated and, finally, a new exact ethod is proposed on the basis of a variable wind field. Applications to the motion of a frictionless, utobarotropic fluid are discussed for straight parallel, divergent, convergent and circular paths. The equations of motion are discussed in a general form. Series and graphical solutions are deeloped. (*Same item as* 10.8–264, Aug. 1959, *MAB.*) *Subject Headings:* **1. Wind deviation 2. Equations of motion 3. Numerical forecasting.**—*A.A.*

11C–180 551.511.6:551.509.313

Starr, Victor P. and Gates, W. Lawrence, **Investigation of the integrated momentum vorticity equation.** (In: Massachusetts Institute of Technology. Dept. of Meteorology, Contract AF 19(122)-153, **Studies of the Atmospheric General Circulation,** Final Report, Pt. 1, May 31, **1954.** p. 285–295. 4 figs., 7 refs., 15 eqs.)—Basic equation derived with wide applicability and very few assumptions, independent of thermal processes, distribution of vertical motion, and including effects of irregular terrain. An approximate form, neglecting secondary effects, can be used for the atmosphere. A numerical example is studied for the field 30–50°N and **70–125°W**, analyzing baro-

tropic and baroclinic effects. (*Same item as* 9.1–182, Jan. 1958, *MAB.*) *Subject Headings:* **1. Va ticity equations 2. Numerical forecasting 3. United States.**—*A.A.*

11C–181 551.509.3

Syōno, S. and Aihara, M. (*Geophysical Inst., Tokyo Univ.*), **Some characteristic features barotropic disturbances, Pt. 1.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 35(1):12–1 Feb. **1957.** 2 figs., 6 refs., 59 eqs. Also: **Pt. 2,** *Ibid.*, 35(2):128–136, April **1957.** 14 figs., 7 refs 95 eqs. **DWB, DLC**—Using the nondimensional barotropic vorticity equation, various aspects barotropic disturbances are investigated. (For a fuller abstract, *see* 9.11–132. Nov. 1958, *MAB Subject Headings:* **1. Numerical forecasting 2. Barotropic theory.**

11C–182 551.509.312:551.55:551.542

Syōno, S. and Yanai, M. (*Geographical Inst., Tokyo Univ.*), **Relationship between the pressur pattern and the wind.** *Meteorological Society of Japan, Tokyo, Journal*, Ser. 2, 35(1):19–25, Feb **1957.** 10 figs., table, 8 refs., 27 eqs. **DWB, DLC**—Using an iterative method in two typical case i.e. a cyclonic and an anticyclonic, 500 mb flow patterns are obtained from the balance equation. is shown that the patterns of stream lines are very similar to those of height contours, but significan differences appear near the center of cyclone. Wind speeds which correspond to the stream line thus calculated give better coincidence with the observed ones than the geostrophic wind speed This improvement is explained chiefly by the concept of gradient wind. Further the integral for of the balance equation is obtained, and it is shown that the departure of the stream lines from th height contours is due to the effects of vorticity and kinetic energy. *Subject Headings:* **1. Numerica wind forecasting 2. Balance equation.**—*Authors' abstract.*

11C–183 551.509.313:551.509.

Syōno, S. (*Geophysical Inst., Tokyo Univ.*), **Boundary errors in numerical weather prediction** *Meteorological Society of Japan*, Tokyo, Journal, Ser. 2, 35(4):242–248, Aug. **1957.** 8 figs., 30 eq **DWB, DLC**—Author discusses the errors of height tendency and vertical velocity caused by assump tions of fictitious boundary conditions, i.e. the height tendency or the vertical velocity vanishes on th side-boundary or at the lower boundary, respectively. Generally speaking, errors penetrate farthe into the forecast area with increase of the scales of errors on and at boundaries. The distribution of errors in the forecast area are given for various types of boundary errors. Comparison between th exact solution and the result of prediction by the barotropic model is made for a disturbance HAURWITZ'S type. *Subject Headings:* **1. Numerical forecasting 2. Boundary errors.**—*Author abstract.*

11C–184 551.509.313:551.511.3

Syōno, S. (*Geophysical Inst., Tokyo Univ.*), **Various simple solutions of the barotropic vorticit equation.** *Meteorological Society of Japan, Tokyo, 75th Anniversary Vol. of the Journal*, pub. Nov **1957.** p. 103–107. 2 figs., table, 13 refs., 28 eqs. **DWB, DLC**—The Jacobian term in the bar tropic vorticity equation vanishes if one of the following conditions is satisfied: (1) $\nabla^2\psi = F(\psi$ (2) $\nabla^2\psi = F(t)$ (3) $\nabla^2\psi$ and ψ are functions of one same space variable. All simple solutions eve obtained satisfy one of these conditions. The author discusses these solutions from unified stand point and notes the existence of certain solutions which hitherto escaped attention. *Subject Heading* **1. Barotropic vorticity equations.**—*Author's abstract.*

11C–185 551.509.313:551.543

Terauchi, Eiichi (*Japan Met. Agency, Tokyo*), **Some problems in graphical methods for numeric prediction of surface pressure patterns.** *Meteorological Society of Japan, Tokyo, 75th Anniversar Vol. of the Journal*, pub. Nov. **1957.** p. 289–295. 4 figs., table, 4 refs., 29 eqs. **DWB, DLC**—Som assumptions used in the graphical method for numerical prediction of surface pressure patterns a examined. The mesh-size, the height of the level of nondivergence, and the vertical distributio of height with pressure, suitable for any graphical methods, are obtained theoretically. *Subje Headings:* **1. Numerical forecasting 2. Graphical forecasting models.**—*Author's abstract.*

11C–186 551.509.313:551.511:551.513

Thompson, P. D., **Baroclinic effects, Pt. 1–2.** (In: American Meteorological Society. Distri of Columbia Branch, **Proceedings of the Workshop on Numerical Weather Prediction, Wash., D. C June 1954.** p. 36–48. 2 figs., eqs.) **DWB**—The usually assumed barotropic model does not allo forecast changes in the intensity of centers of maximum and minimum vorticity, a deficiency th author attempts to correct by accounting for baroclinic effects. The underlying theory is develope and necessary simplifications are introduced. At first a two layer system is assumed based upon th contour pattern of 250 and 750 mb surfaces and then the numerical method of successive approxim

ns is proposed to account for any number of layers. *Subject Headings:* **1. Baroclinic models Numerical forecasting.**—*A.A.*

11C–187 551.509.313

Thompson, Philip D., **Numerical predictions: an exposition and review for the nonspecialist.** *nerican Meteorological Society, Bulletin*, 38(8):447–452, Oct. **1957.** 2 figs., 3 refs. **DWB.** (For stract *see* 10.9–155, Sept. 1959, for abstract from different source 8F–164, June 1957, *MAB.*) *bject Headings:* **1. Numerical forecasting 2. U. S. Joint Numerical Weather Prediction Unit.**

11C–188 551.509.313:551.509.5

Thompson, Philip Duncan, **Uncertainty of initial state as a factor in the predictability of large ale atmospheric flow patterns.** *Tellus*, Stockholm, 9(3):275–295, Aug. **1957.** 3 figs., 12 refs., eqs. **DWB, DLC.** (For abstract, *see* 10.7–170, July 1959; for abstract from different source, –134, June 1957, *MAB.*) *Subject Heading:* **1. Numerical forecast errors.**

11C–189 551.509.58:551.509.25

*U. S. Air Force. 2d Weather Wing, Rhein Main Air Base, Germany, **Comparison of the accuracy numerical and conventional prognostic charts and their value as flight planning tools.** Jan. **1958.** p. 23 figs., 4 tables. **DWB** (M:629.1325 U58com)—Daily 500 mb prognostic charts prepared the Joint Numerical Weather Prediction Unit for the period Nov. 1956–July 1957 are used to mpute equivalent headwind components along four standard air routes across the North Atlantic d over western Europe. The errors in these route winds are compared with those resulting from e use of conventionally prepared prognostic charts, persistence, and climatology as forecast tools. ne growth of the wind error with time and route length obtained from each of these forecasts is amined for the purpose of determining at what point in time prognostic charts cease to have value flight planning tools relative to the unskilled objective forecasts of persistence and climatology. *bject Headings:* **1. Prognostic chart accuracy 2. Numerical forecasting evaluation 3. Flight anning.**—*Author's abstract.*

11C–190 551.509.312:551.511

van de Lindt, W. J., **Numerical integration of the barotropic vorticity equation.** *Remington and Univac, Phila., Penna., Applications Research Center Report, Technical Report*, No. 19, March 3, **1958.** 29 p. 5 figs., 7 refs., 9 eqs. Reproduced from typescript.—In principle, it is possible to scribe exactly the motion of the atmosphere by using equations of thermodynamics and motion. n practice, exactness is not yet attainable because the problem is too complex. With the help of vere approximations, however, various mathematical models—idealized pictures—of atmospheric ehavior may be constructed. The simple equations which result, describe most, though not all, the main features of atmospheric behavior. For instance, the assumption that each air particle tains its initial pressure results in the so-called barotropic equation or model; this equation describes physically stable atmosphere. But, while it adequately represents disturbances already present n the atmosphere, it cannot create new disturbances. The mathematical simulation of new disturbances requires construction of a different equation; under certain conditions the solution of this quation can simulate a physically unstable atmosphere. If a temperature gradient in the isobaric urfaces is included in the model, the resulting equation reflects the particular instability. This nodel is called thermotropic. A description of the barotropic model and a program for the numerical ntegration of its equations on UNIVAC I appear in this report. *Subject Headings:* **1. Barotropic orticity equations 2. Electronic computer programs.**—*Author's abstract.*

11C–191 551.509.312:551.511

Vanderman, Lloyd W.; Drewes, William J. and Hopp, Leo E., **Comparison of barotropic and aroclinic numerical forecasts and contributions of various effects.** *Monthly Weather Review*, Vash., D. C., 87(2):43–56, Feb. **1959.** 8 figs., 2 tables, 9 refs., 6 eqs. **DWB, DLC**—500 mb, baroropic and 500 mb, baroclinic numerical forecasts for two cases, a developing baroclinic cyclone and quasibarotropic cyclone, are presented and compared. The barotropic forecasts did not indicate ccurately the changes in circulation or the magnitude of the height falls ahead of the circulation naxima. 700 mb forecasts from the same initial times as the 500 mb barotropic and baroclinic orecasts, for each of the four terms of the frictionless vorticity equation, are presented. These 700 nb forecasts are compared with each other and in added combinations with the 700 mb verifications nd with 700 mb barotropic forecasts. These comparisons are then used diagnostically in an analysis f the errors in the 500 mb barotropic forecasts. Each of the four terms of the vorticity equation is iscussed. An explanation for the success of the barotropic forecasting model is suggested. Conributions of the horizontal velocity divergence, vertical advection of vorticity, and twisting terme o errors in the barotropic forecasting model are discussed in some detail. It is concluded that ths najor problem in developing a successful baroclinic forecasting model to substitute for the existing

barotropic forecasting model is that determining in space and time an accurate approximation of th profile of vertical motion. *Subject Headings:* **1. Numerical forecasting errors 2. Barotropic mode 3. Baroclinic models.**—*Authors' abstract.*

11C–192 551.513.1:551.509.31

§Vederman, Joseph and Hubert, William E. (*both, Joint Numerical Wea. Prediction Unit. Suitland Md.*), **On the conservation of finite-difference absolute vorticity in barotropic forecasts.** *Monthly Weather Review*, Wash., D. C., 85(6):193–199, June **1957.** 6 figs., 3 tables, 4 refs., 6 eqs. **DWI DLC**—In solving the differential equations used in numerical weather prediction, one resorts to th use of finite-difference techniques. In the barotropic model it is assumed that the absolute vorticit is conserved. Even though the differential form of the vorticity equation insures conservation, th finite-difference form may not. The purpose of this study is to test this assumption in order t find out how serious truncation errors really are. The results indicate that the finite-differenc absolute vorticity is reasonably well conserved, at least up to 48 hrs. (*Same item as* 10.3–16 March 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting techniques 2. Finite-differenc absolute vorticity.**—*Authors' abstract.*

11C–193 551.509.31

Vítek, Vojtěch (*Met. Inst., Charles Univ., Prague*), **K otázce prognostického využití rovnic divergence.** [Use of the divergence equation in forecasting.] *Meteorologické Zprávy*, Prague 10(6):144–145, **1957.** 2 refs., 18 eqs. Russian and English summaries p. 144. **DWB**—A baroclini model using the vorticity equation and divergence equation is proposed. *Subject Headings:* **1. Baro clinic model 2. Divergence analysis.**—*Author's abstract.*

11C–194 551.509.313:551.51

Vítek, V., **A contribution to the study of the barotropic model of the atmosphere.** *Studia Geophysica et Geodaetica*, Prague, 1(1,2):124–140, 310–326, **1957.** 10 refs., 50 eqs. **DWB**— mathematical derivation of the position of the level of nondivergence in the atmosphere has bee established which could be applied to the barotropic vorticity equation and thus improve the quality of forecasting. The results obtained are satisfactory because a theoretical analysis of the mechanism of changes in height of the level of nondivergence always indicates the position of the level of non divergence as a function of the quantities that characterize the stage in the development of the pressure system. The model described has a few deficiencies which can be eliminated before the prognostic equations are set up. These equations make possible the forecasting of the pressure system at the level of nondivergence and of the surface pressure field. *Subject Heading:* **1. Barotropic models.**—*N.N.*

11C–195 551.55:551.542.1:551.509.31

Vítek, V., **A note on the physical interpretation of the balance equation.** *Studia Geophysica et Geodaetica*, Prague, 1(2):385–386, **1957.** ref., 7 eqs. **DWB**—A balance equation based on the Corioiis parameter is reduced to the relation for the geostrophic vorticity by equating the nonlinear terms to zero. The solution of this equation is given, and it prescribes the geometric properties of the corresponding field of motion. One of the equations solved presents a sufficient condition for the vorticity of the horizontal nondivergent flow to be equal to the geostrophic vorticity. This additional information partly explains how the models based on geostrophic hypothesis relatively rarely fully predict the positions and intensity of the centers of cyclones and anticyclones. *Subject Heading:* **1. Balance equation.**—*N.N.*

11C–196 551.509.313:551.577.21

Vítek, V., **A contribution to the numerical forecasting of precipitation.** *Studia Geophysica et Geodaetica*, Prague, 2(1):54–70, **1958.** 19 refs., 25 eqs. **DWB**—In this study on the numerical forecasting of precipitation, the following simplifying assumptions are made: 1) the adiabatic assumption; 2) that liquid water produced by condensation or the products of sublimation fall from the cloud without remainder as precipitation; and 3) that precipitation reaches the earth below the cloud base. An equation is derived for the total intensity of precipitation, which is shown to depend not only upon vertical velocity but upon the thermodynamic properties of the whole phenomenon. By mathematical means the thermodynamic (influence of terrain) and the dynamic (relative divergence) components of the precipitation intensity equation are separated and the influence of thermodynamic factors in both components is analyzed. The final relationship for the dynamic components of precipitation was described in combination with the equation of development of SUTCLIFFE and SUMNER. The effect of locality upon the origin of precipitation was analyzed mathematically. The relations for the intensity of precipitation was examined from the point of view of numerical forecasting with the aid of a baroclinic model with a mobile level of nondivergence, the prognostic equations

which were described by BRANDEJS and VÍTEK. *Subject Heading:* **1. Numerical precipitation forecasting.**—*I.L.D.*

11C–197 551.509.312:551.511:551.513

Vítek, V., **Remark on some of the properties of horizontal non-divergent flow.** *Studia Geophysica et Geodaetica*, Prague, 2(4):406–407, **1958.** ref., 10 eqs. Russian summary p. 407. **DWB**—The conditions of the coincidence of an isobaric surface with the level of zero divergence are considered. The theorem that a necessary and sufficient condition for the isobaric surface to be identical with the level of nondivergence is the conservation of circulation in this surface is proven by deriving the equation

$$\frac{\partial v_x}{\partial x} + \frac{\partial v_y}{\partial y} = 0.$$

This theorem is proven independently of the theorem that the isobaric surface is identical with the level of nondivergence if and only if the following condition is satisfied in the surface

$$\frac{\partial \dot{v}_x}{\partial y} - \frac{\partial \dot{v}_y}{\partial x} = 0,$$

This is if the expression $\dot{v}_x(x,y)dx + \dot{v}_y(x,y)dy$ is the total differential of some function which depends on the horizontal coordinates. *Subject Heading:* **1. Nondivergent flow.**—*I.L.D.*

11C–198 551.509.312:551.511:551.513.1

Vítek, V., **The use of the deformation theorem in forecasting non-divergent flow.** *Studia Geophysica et Geodaetica*, Prague, 3(3):291–293, **1959.** 2 refs., 12 eqs. Russian summary p. 293. **DWB**—On the basis of the vorticity, balance and deformation equations a system of two prognostic equations is developed for forecasting the geopotential and the flow coefficient in zonal nondivergent flow. A method is proposed for the numerical solution of this system. *Subject Headings:* **1. Deformation theorem 2. Nondivergent flow 3. Numerical forecasting.**—*G.T.*

11C–199 551.509.312

Vítková, Dagmar (*Hydromet. Inst., Prague*), **A baroclinic model for forecasting height of arbitrary isobaric surface.** *Studia Geophysica et Geodaetica*, Prague, 2(3):296–298, **1958.** 4 refs., 4 eqs. Russian summary p. 298. **DWB**—From the equations of vorticity and divergence, a model is developed for predicting the height of any pressure surface under the assumption that vertical velocity is negligible. The model does not include any simplifying assumptions concerning the variations of wind along the vertical coordinate. *Subject Heading:* **1. Baroclinic models.**—*Transl. of authors' abstract.*

11C–200 551.509.312:551.515.71

Vítková, D. and Vítek, V., **The production of spurious anticyclogenesis.** *Studia Geophysica et Geodaetica*, Prague, 3(2):199–200, **1959.** 2 refs., 7 eqs. Russian summary p. 200. **DWB**—In numerical and graphical forecasts by geostrophic models the intensity of anticyclonic systems is often over-estimated. The authors show that "spurious anticyclogenesis" can be a direct result of geostrophic approximation. The discussion begins with the equation of motion of horizontal friction-less flow. Interpretation of the production of spurious anticyclogenesis is developed. The conclusions of the paper are to be regarded as preliminary until a detailed analysis through practical tests of some geostrophic model using an electronic computer is possible. *Subject Headings:* **1. Numerical forecasting errors 2. Spurious anticyclogenesis.**—*I.S.*

11C–201 551.509.313:551.515.2(52)

Vortex: Collected papers of the Numerical Weather Prediction Group in Tokyo, Nos. 2 and 3, issued June **1957** and **1958.** **DWB**—These two collections contain reprints of papers in English by Japanese authors on various aspects of numerical forecasting, all originally issued in *Meteorological Society of Japan, Journal* and *Papers in Meteorology and Geophysics*, Tokyo (1956–1958 issues) and abstracted from these original sources. No. 2 contains 18 papers (for listing, *see* p. 1046, Aug. 1958, *MAB*), No. 3, 27 papers. (*Same item as* 9.11–3 and 10.7–1, Nov. 1958 and July 1959, *MAB*.) *Subject Headings:* **1. Numerical forecasting studies 2. Numerical typhoon forecasting. I. Japan. Numerical Weather Prediction Group, Tokyo.**

11C–202 551.509.312:551.511:551.513.1

Wales-Smith, B. G., **The preparation and use of charts of the distribution of relative vorticity.** *Meteorological Magazine*, London, 88(1039):4–15, Jan. **1959.** 11 figs., table, 4 refs., eq. **DWB,**

DLC—The distribution of vorticity (by which latter is here meant the vertical component of th geostrophic vorticity relative to the earth) in a given 1000 mb surface is determined by means of graphical technique. This distribution is compared with that published for the same set of contou in a paper by Sawyer and it is shown that the two versions are very similar. Certain appare practical advantages of the graphical method are discussed. The graphical methods of producin actual and prognostic patterns of vorticity are described. An analysis of 24-hour forecasts of th distribution of vorticity at 500 mb is made. A reasonably satisfactory degree of success is shown have been attained in these forecasts. A brief appendix deals with the relationship between vorticit and the shear and curvature properties of contour charts. *Subject Heading:* **1. Fjørtoft's graphic method.**—*Author's abstract.*

11C–203 551.509.317:551.511

Watanabe, T., [**Comments on**] **Charney-Eliassen's fundamental equation for numeric prediction.** *Journal of Meteorological Research*, Tokyo, 9(6):449–450, July **1957.** 4 refs., 4 eqs. J Japanese **DWB.** (For abstract of original article, *see* 5F–21, June 1954, *MAB.*) *Subject Heading* **1. Numerical forecasting 2. Barotropic models 3. Charney-Eliassen method.**

11C–204 551.509.312:551.513

Wiin-Nielsen, Aksel (*Joint Numer. Wea. Pred. Unit, Suitland, Md.*), **On barotropic and barc clinic models, with special emphasis on ultra-long waves.** *Monthly Weather Review*, Wash., D. C 87(5):171–183, May **1959.** 13 figs., 18 refs., 8 eqs. **DWB, DLC**—The problem of control of th ultra-long waves in numerical prediction is considered. Sec. 2–4 contain a discussion of the one-lev forecasts. It is shown that the vertical variation of horizontal wind and static stability are the mai factors in determining the value of divergence at 500 mb. An independent estimate of the size of th term governing the ultra-long waves in the atmosphere agrees well with the one determined b CRESSMAN on an empirical basis. Sec. 5 points out that any two-parameter model has to contai an effect similar to the one contained in the one-parameter model controlling the ultra-long wave A modification of a two-parameter model is made in such a way that the ultra-long waves are con trolled. Sec. 6 describes a perturbation analysis of the model developed in Sec. 5 in order to in vestigate the effect of the modification also on the shorter waves. It is found that a certain stabiliza tion of the shorter waves is produced. Baroclinic instability and growth rate are investigated Sec. 7 and 8 contain a justification of certain approximations used in the earlier sections regarding th vertical variation of static stability and the profile of vertical velocity. *Subject Headings:* **1. Wave in the westerlies forecasting 2. Numerical forecasting and ultralong waves.**—*Author's abstract.*

11C–205 551.509.312:551.511.

Wiin-Nielsen, A. (*Internat. Met. Inst., Stockholm*), **On certain integral constraints for the time integration of baroclinic models.** *Tellus*, Stockholm, 11(1):45–59, Feb. **1959.** fig., 9 refs., 35 eqs **DLC**—On the basis of the general property of the vorticity equation that the net-production o vorticity vanishes in the average over a closed region it is shown in Sec. 3 that provided this property should be fulfilled one should at the same time include or exclude the vertical advection of vorticity and the twisting effect in two-parameter models used for numerical weather prediction. The advection with the divergent part of the horizontal wind and the part of the divergence term which depends upon the relative vorticity has a similar opposing effect in the mean production of vorticity for the nondivergent level, but a vanishing production of thermal vorticity can only be obtained i one either includes the advection with the divergent wind and the complete divergence term o excludes the advection with divergent wind, the part of the divergence term depending upon the relative vorticity and consider the Coriolis parameter in the remaining part of the divergence term as a constant. In Sec. 4 it is shown that the mean value over a closed region of the relative topography remains constant in a two-parameter model provided the vertical stability parameter is constant. It is further shown that the thermodynamic equation in the adiabatic case is far less sensitive to inconsistencies than the vorticity equation. Sec. 5 contains a comparison between the growth of "rotational energy" in general and simplified two-parameter models. It is shown that already the most simple model contains approximately the correct growth rate. A similar comparison with respect to the rate of "occlusion" is made in Sec. 6 with a similar result. Sec. 7 contains a comparison between the theoretical results and the experience from practical computations. The mechanism for production of kinetic energy of the nondivergent part of the wind is discussed in Sec. 8 *Subject Heading:* **1. Baroclinic models.**—*Author's abstract.*

11C–206 551.509.312:531.314

Wiin-Nielsen, A., **On the application of trajectory methods in numerical forecasting.** *Tellus*, Stockholm, 11(2):18–196, May **1959.** 3 figs., 3 tables, 18 refs., 64 eqs. **DWB, DLC**—On the basis of a comparison between the results so far obtained by the usual numerical methods in physical weather prediction and the graphical methods it is likely that certain defects in the present forecast

ethods are due to the Eulerian technique. The possibilities for the use of a quasi-Lagrangian chnique are investigated, and it is found that such a technique is possible and becomes especially nple when combined with a space smoothing which eliminates the shorter fast moving waves in the ectrum. The Lagrangian method of computation is described in the barotropic case and also r a simplified two-parameter baroclinic model. *Subject Headings:* **1. Numerical forecasting chniques 2. Trajectory methods in numerical forecasting.**—*Author's abstract.*

11C–207 551.509.313:551.509.5

Williams, Scott (*Capt., U. S. A. F.*), **An empirical correction to the barotropic forecast.** *Tellus*, ockholm, 10(2):216–224, May **1958.** 10 figs., 6 tables, 5 refs. **DWB, DLC**—An investigation of ror fields in 30 consecutive barotropic forecasts for the 500 mb surface has been performed. It is und that the error fields show persistence in the time to such an extent that a correction consisting the mean error field for a number of preceding forecasts can be applied to a barotropic forecast ith advantage. The improvement of the forecast depends upon the number of preceding forecasts cluded in the mean error field. The greatest increase in accuracy is found when 10–15 preceding recasts are contributing to the correction field. The 24-hr forecasts are improved to the greatest xtent by the correction, but the 48 hr-forecasts also show a significant increase in accuracy. The me is true to a smaller extent for the 72 hr-forecasts. In Sec. 3, an investigation is made as to hether the height change obtained by making barotropic forecasts from the time-averaged map r the period investigated or from the normal 500 mb map for the corresponding month can be used ith the same success as the correction used in Sec. 2. It is found that the correction from the mean hart consistently improved the forecasts. The overall effect is, however, small. The correction btained from the normal chart did not affect the accuracy of the forecasts appreciably. (*Same item* s 10.2–153, Feb. 1959, *MAB.*) *Subject Heading:* **1. Barotropic forecast corrections.**—*Author's bstract.*

11C–208 551.509.313

Wolff, Paul M., **Error in numerical forecasts due to retrogression of ultra-long waves.** *Monthly Weather Review*, Wash., D. C., 86(7):245–250, July **1958.** 10 figs., 3 tables, 5 refs., 5 eqs. Also: Clapp, Philip F. **Comments.** *Ibid.*, 86(8):298–328, Aug. **1958.** 8 refs., 8 eqs. **DWB, DLC.** Preliminary version of original issued as *U. S. Joint Numerical Weather Prediction Unit, Technical Memorandum*, No. 13, April **1958.** 9 p. charts, 3 tables. **DWB** (M09.312 U583t)—Error charts or the numerical barotropic forecasts prepared at the Joint Numerical Weather Prediction Unit ince Oct., 1957 have revealed retrogressive patterns of very long wave-length. These errors are hown to be due to changes in the large scale components predicted by the numerical model. These omponents are actually quasi-stationary in the atmosphere. Forecasts prepared with an approximation to these components held unchanged show significantly increased accuracy. Finally, ome of the difficulties in developing a more acceptable physical approach to this problem are outned. (*Same item as* 10.9–157, Sept. 1959, *MAB.*) *Subject Heading:* **1. Numerical forecast errors.** —*Author's abstract.*

11C–209 551.509.313:551.509.5

Wu, Yon-shen (*Nanking Univ.*), **Scheme of numerical forecasting of 500 mb field.** *Acta Meteorologica Sinica*, Peking, 30(2):165–172, **1959.** 6 figs., table, 8 refs., 23 eqs. In Chinese; English summary p. 172. **DWB**—A basic equation for predicting 500 mb topography is obtained on the following two assumptions: (1) the level of $P=0$ is a horizontal plane, (2) its height H does not change with time. This equation is very similar to that for a barotropic case, but with certain essential differences. In this article, the author also points out that in the barotropic case, taking a smaller grid will produce better results than a large grid. The examples of forecasting show that his method is rather successful. *Subject Heading:* **1. Numerical forecasting techniques.**—*Author's abstract.*

11C–210 551.509.313:551.55:551.542.1

Zikmunda, Otakar, **Prognoz vysoty absoliutnoĭ topografii 1000 mb, vyvedennyĭ s pomoshch'iu graficheskogo metoda.** [Forecasting the height of the 1000 mb surface by a graphical method.] *Studia Geophysica et Geodaetica*, Prague, 1(1):157–172, **1957.** 4 figs., 2 tables, 7 refs., 25 eqs. English summary p. 172. **DWB**—From Sutcliffe's relative divergence and vorticity equation, a formula is derived for local changes of vorticity at the 1000 mb surface. By means of a geostrophic approximation the formula can be used for forecasting the height of that surface. The formula can be integrated graphically. Results of the graphical integration have been verified statistically. It is found that the accuracy of the proposed method is similar to that of Fjørtoft. (*Same item as* 10.9–158, Sept. 1959, *MAB.*) *Subject Headings:* **1. Numerical forecasting 2. Geostrophic approximation 3. Graphical forecasting models.**—*Author's abstract.*

11C–211 551.509.313:551.577.2

Zikmunda, Otakar (*Czechosl. Acad. of Sci., Prague*), **An attempt at objectively calculating th amount of precipitation.** *Studia Geophysica et Geodaetica*, Prague, 3(3):281–287, 1959. 2 figs 3 tables, 4 refs., 5 eqs. Russian summary p. 287. Also his: **Remarks on objective calculation amount of precipitation.** *Ibid.*, 3(4):403–408, 1959. 3 figs., 3 tables, 5 refs., 6 eqs. **DWB**— baroclinic prediction model is adapted to calculating vertical velocities from which precipitatio amounts can be derived. In the first paper the method is worked out assuming uniform stratificatio and complete saturation above the condensation level. Application to a specific case produce a) predicted amounts systematically too high and b) forecasts of precipitation where none occurre The first error could be eliminated to a large degree by using a constant reduction factor, but th second error required refinement of the method. In the second paper such a refinement is attempte by omitting the simplifying assumptions of uniform stratification and saturation. The modifie equation appears to yield better results. The author considers the results promising despite th remaining errors which he discusses in some detail. *Subject Headings:* **1. Numerical precipitatio forecasting 2. Numerical forecasting errors.**—*G.T.*

PART III. TRANSLATIONS, RECENT MONOGRAPHS, AND ANALYTICS FROM SERIALS AND COLLECTED WORKS

Note: Material listed in these sections will not be included in the monthly indexes until abstracted. The item number is mentioned for those titles which have been abstracted in previous issues of *Meteorological Abstracts.*

A. TRANSLATIONS

Belousov, S. L.: **International Conference on Numerical Forecasting Methods.** (Transl. of original Russian, **Mezhdunarodnaia konferentsiia po Chislennym Metodam Prognoza,** in *Meteorologiia i Gidrologiia*, No. 9:58–59, 1957.) Transl. into English by Valyz Zilius issued by American Meteorological Society under Contract AF 19(604)-1936. Available Library of Congress or Special Libraries Association, as their 59-12195. Microfilm, price $1.80

Gal'perin, Iu. I.: **Hydrogen emission and two types of aurorae spectra.** (Transl. of original Russian, **Vodorodnaia emissiia i dva tipa spektrov poliarnykh siianiĭ,** in Krasovskiĭ, V. I., ed., **Spektral'nye, elektrofotometricheskie e radiolokatsionnye issledovaniia poliarnykh siianiĭ i svecheniia nochnogo neba.** Issued Moscow, Akademiia Nauk SSSR, 1959.) Transl. by J. Miller issued July 1959 by American Meteorological Society under Contract AF 19(604)-1936, as its Transl. T-RC-14+, p. 1–19. Another English version appeared in *Planetary and Space Science*, N. Y., 1(1):57–62, Jan. 1959. 4 figs., 22 refs. (*For abstract from this last source, see* 10.10–304, Oct. 1959, *MAB*)

Kachurin, L. G.; Zaitseva, N. A. and Lomanova, S. R.: **Temperature limits for formation of ice particles in supersaturated water vapor.** (Transl. of original Russian, **O temperaturnykh granitsakh obrazovaniia ledianykh chastits v peresyshchennom vodianom pare,** in *Akademiia Nauk SSSR, Izvestiia, Ser. Geofizich.*, No. 7:857–861, 1956.) Transl. into English by E. R. Hope issued as *Canada. Defence Research Board, Transl.* T-237-R, Jan. 1957. 6 p. incl. illus. and tables. Available ASTIA as its AD-145-401. (*See* 9.10–225, Oct. 1958, *MAB*)

Kuzivanov, V. A.: **Concerning the analytical extension of the gravity potential in the internal field.** (Transl. of original Russian in *Akademiia Nauk SSSR, Izvestiia, Ser. Geofizich.*, No. 12:1419–1426, 1956.) English transl. issued by U. S. Joint Publications Research Service as its JPRS-NY-L-1, March 3, 1958, available Library of Congress or Special Libraries Association as 59-12210. Microfilm, price $2.40

Leningrad. Glavnaia Geofizicheskaia Observatoriia: **Modern problems in the meteorology of the near surface atmospheric layer: collection of articles.** (Original Russian, **Sovremennyie problemy meteorologii prizemnogo sloia vozdukha: sbornik statei,** issued Leningrad, Gidrometeoizdat, 1958. 231 p.) "Book exploitation" in English (3 p.) showing coverage of book and detailed table of contents, available U. S. Office of Technical Services as its BE-966. Price $0.50

Monakhov, F. I.; Pasechnik, I. P. and Shebalin, N. V.: **Seismic and microseismic observations at the Soviet stations during the IGY.** (Transl. of original Russian, **Seismicheskie i mikroseismicheskie nabliudeniia na sovetskikh stantsiiakh v period MGG.** Issued Moscow, Akademiia Nauk SSSR, 1959. 40 p.) English transl. issued by American Meteorological Society under Contract AF 19(604)-1937, as its T-R-258+. 42 p.

Parmuzin, Iu. P.: **Zonal character of the cold pole.** (Transl. of original Russian, **O zonal'noĭ prirode poliusa kholoda,** in *Vsesoiuznoe Geograficheskoe Obshchestvo, Leningrad, Izvestiia*, 90(5):472–474, Sept./Oct. 1958.) English transl. issued in *Soviet Geography*, N. Y., 1(1/2):40–42, Jan./Feb. 1960.

Petrichenko, A. N.: **Preliminary data on the drift of the Sedov for 1937 and 1938.** (Transl. of original Russian, **Predvaritel'nye dannye dreĭfa "Sedova" v 1937 i 1938 godakh,** in *Problemy Artiki*, Leningrad, No. 2:69–85, 1940.) English transl. by James Gough, Jr. and David Kraus, issued by American Meteorological Society, April 1953. 29 p. Available Library of Congress or Special Libraries Association, as PB 130–600t. Microfilm, price $3.60

Universe discloses its secrets: investigation of cosmic space by means of rockets and satellites. (Transl. of original Russian, **Vselennaia raskryvaet svoi taĭny: issledovanie kosmicheskogo protranstva s pomoshch'iu raket i sputnikov,** in *Pravda*, Moscow, 48(96, i.e. 14,955):3–4, July 15, 1959. photo, 8 figs. DLC.) English transl. available as ASTIA AD-226,312.

Vurkov, V. A. and Arsen'ev, V. S.: **Essai de délimitation des masses d'eau dans la zone de contact du Kouri Chivo et du courant des Iles Kouriles** (Attempt at a determination of water masses in the contact zone between the Kuroshio and Kurile currents). (Transl. of original Russian **Opyt vydeleniia vodnykh mass v zone soprikosnoveniia Kurosio i Kuril'skogo techeniia,** in *Akademiia Nauk SSSR. Institut Okeanologii, Trudy*, 27:5–11, 1958. 4 figs., table.) Transl. into French in *France. Comité Central d'Océanographie et d'Etudes des Côtes, Cahiers Océanographiques*, 11(8):578–584, Sept./Oct. 1959. 4 figs., etc. Transl. available DWB, DLC

Walden, Hans: **Low with a warm sector over the Greenland Massive.** (Transl. of original German **Ein Tief mit Warmsektor über dem Grönlandmassiv,** in *Zeitschrift für Meteorologie*, Berlin 12(4/6):147–154, April/June 1958. 7 figs., table, 26 refs.) Free transl. into English included in Paul Putnins and W. Schallert et al., **Some meteorological and climatological problems of the Greenland Area.** U. S. Weather Bureau, Contract DA-3-99-04-112, Final Report, issued Dec. 1959, p. 188a–188g. Transl. available DWB (M(051) U587fi)

Yosida, Zyungo: **Quantitative study of the metamorphism of snow crystals by sublimation.** (Transl. of original Japanese (Romanized) **Yuki no kesshō no shōka henkeī ni tsuite no teiryō-teki kosatsu** in *Low Temperature Science, Ser. A, Physical Sciences*, Sapporo, Japan, 13:11–28, 1954. 6 figs., 5 refs., 50 eqs.) English transl. issued as *U. S. Snow Ice and Permafrost Research Establishment Translation* No. 57, May 1958. 6 figs., etc. 10 p. Available DLC

B. RECENT MONOGRAPHS

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Baur, Franz: **Die Sommerniederschläge Mitteleuropas in den letzten 1½ Jahrhunderten und ihre Beziehungen zum Sonnenfleckenzyklus** [Summer precipitation in Central Europe in the last 150 years and its relation to the sunspot cycle]. Leipzig, Geest & Portig, 1959. 80 p. figs. tables. Price DM 9.—

Blizniak, Evgeniĭ Varfolomeevich: **Rukovodstvo k barometricheskomu nivelirovaniiu** [Handbook on barometric hypsometry]. 3d ed. Moscow, Ob"edinennoe Nauchno-Tekhn. Izdvo NKTP SSSR, 1936. 180 p. figs., maps, refs. DLC (QC895.B67 1936)

Dungey, J. W.: **Cosmic electrodynamics.** Cambridge, University Press, 1958. 183 p. (*Cambridge Monographs on Mechanics and Applied Mathematics.*) Price 32 sh 6d. **DLC** (QC809.E55D8 Review by E. V. Appleton in *Journal of Atmospheric and Terrestrial Physics*, N. Y., 17(1/2):179 Dec. 1959.

Grandjean, J.: **Chimie et radioactivité atmosphériques** [Atmospheric chemistry and radioactivity] Brussels, Institut Royal Météorologique de Belgique, 1959. 24 p.

Hubbard, Philip Gamaliel: **Operating manual for the IIHR hot-wire and hot-film anemometers** Iowa City, State Univ. of Iowa, 1957. 34 p. figs. DLC (QC932.H9)

Iselin, Columbus O.: **Matthew Fontaine Maury, 1806–1873: pathfinder of the seas: the development of oceanography.** N. Y., Newcomen Society in North America, 1957. 28 p. figs. DLC (GC30.M418)

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Johansson, Oscar V.: **Ergänzende Beiträge zur Kenntnis des jährlichen Temperaturganges in Europa** [Supplementary contribution to the knowledge of the annual temperature conditions in Europe]. *Finska Vetenskaps-Societeten, Helsinki, Commentationes Physico-Mathematicae* Vol. 17, No. 3, 1957. 49 p. refs. DLC (Q60.F555)

Johansson, Oscar V.: **Die Temperaturverteilung in S-Finnland** [Temperature distribution in South Finland]. *Finska Vetenskaps-Societeten, Helsinki, Commentationes Physico-Mathematicae* Vol. 17, No. 5, 1957. DLC (Q60.F555)

King, C. A. M.: **Beaches and coasts.** London, Edward Arnold, 1959. 403 p. 149 figs. Price 65 sh. DLC (GB451.K5)

Kramp, Paul Lassenius: **The Hydromedusae of the Atlantic Ocean and adjacent waters.** Copenhagen, Høst and Son, 1959. 283 p. Price 60 Danish Kr. (*Dana Report* No. 46.) Review by J. H. Fraser in *Nature*, 184(4683):300–301, Aug. 1, 1959.

Kunkel, Günther: **Meteorologisch-mikroklimatologische Beobachtungen in Valdivia (Südchile)** [Meteorological-microclimatological observations in Valdivia, Southern Chile]. *Akademie der Wissenschaften, Berlin, Klasse f. Chemie, Geologie und Biologie, Abhandlungen*, No. 14, (1959?) 104 p. 56 figs., 30 tables.

Levens, A. S.: **Nomography.** 2d ed. N. Y., John Wiley, 1959. 296 p. Price $8.50 (Rev. and expanded over 1948 first ed. by 90%). DLC (QA90.L45 1959)

aull, Otto: **Handbuch der Geomorphologie** [Handbook of geomorphology]. Vienna, Verlag Franz Deutike, 1958. 2d enl. ed. 600 p. Price 74 Dm. DLC (GB53.M35 1958). Review by S. Müller in *Zeitschrift für Meteorologie*, 13(7/8):198, July/Aug. 1959.

etherlands. Department van Marine: **Meteorologie Nederlands Nieuw Guinea: voorlopige atlas** [Meteorology of Dutch New Guinea: preliminary atlas]. 's-Gravenhage, Staatsdrukkerij, 1959. 1 vol. (chiefly colored maps & diagrs.). DLC (G2441.C8N4)

lmén, Erik Herbert: **On the mean meridional circulation in low latitudes of the Northern Hemisphere in winter and the associated meridional and vertical flux of angular momentum.** *Finska Vetenskaps-Societeten, Helsinki, Commentationes Physico-Mathematicae*, Vol. 17, No. 8, 197. 33 p. figs., refs. DLC (Q60.F555)

odd, David Keith: **Ground water hydrology.** N. Y., John Wiley, 1959. 336 p. Price $10.75. DLC (GB1003.T56). Review by A. Nelson Sayre in *American Geophysical Union, Transactions*, 40(4):351, Dec. 1959.

U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby?]: **Agroklimaticheskiĭ spravochnik po Khar'kovskoĭ oblasti** [Agroclimatological handbook of the Kharkhov region]. Leningrad, Gidrometeoizdat, 1957. Review by I. Ia. Korostelev in *Meteorologiia i Gidrologiia*, Moscow, No. 11:61–62, Nov. 1959.

C. METEOROLOGICAL ARTICLES APPEARING IN RECENTLY ISSUED PUBLICATIONS

ir Pollution Control Association, 52nd Meeting, Los Angeles, Calif., June 21–26, 1959, Proceedings

Pertinent Papers:

Sussman, Victor H.; Lieben, Jan and Cleland, John G.: **An air pollution study of a community surrounding a beryllium plant.** Paper No. 9 (10 p.)

Hamming, Walter J.; MacPhee, Robert D. and Taylor, James R.: **Contaminant concentrations in the atmosphere of Los Angeles County.** Paper No. 13 (6 p.)

Taylor, George J.: **Air pollution monitoring in California.** Paper No. 14 (10 p.)

Soldat, J. K.: **Monitoring for air-borne radioactive materials at Hanford atomic products operation.** Paper No. 15 (11 p.)

Ford, H. W. and Schuck, E. A.: **Photochemistry in smog research.** Paper No. 34 (8 p.)

Goetz, Alexander; Stevenson, Heber J. R. and Preining, Othmar: **The design and performance of the aerosol spectrometer.** Paper No. 40 (22 p.)

Mueller, Peter K.; Helwig, H. L. and Peterson, Conrad L.: **Some performance characteristics of the Goetz aerosol spectrometer Model D. Paper No. 41** (23 p.)

Goetz, Alexander; Preining, Othmar and Stevenson, Heber J. R.: **The analysis of aerosol spectra.** Paper No. 42 (29 p.)

Gomez, Germaine and Quebedeaux, W. A., Jr.: **Routine monitoring of radioactivity of materials in rainfall and atmosphere.** Paper No. 45 (13 p.)

Wiley, Adam and Tow, Philip S.: **Radiological program of the Los Angeles County Air Pollution Control District.** Paper No. 46 (6 p.)

Leavitt, Jack M.: **Meteorological considerations in air quality planning.** Paper No. 62 (19 p.)

Singer, Irving A.: **An objective method for site evaluation.** Paper No 63 (13 p.)

Holland, William D.; Hasegawa, Akira; Taylor, James R. and Kauper, Erwin K.: **Industrial zoning as a means of controlling area source air pollution.** Paper No. 64 (22 p.)

ngewandte Meteorologie, Berlin, Vol. 3, No. 8, Sept. 1959

Fuss, Franz: **Nächtliche Temperaturverhältnisse zweier Weinberge im Elbtal,** [Nocturnal temperature conditions in two vineyards in the Elbe Valley], p. 225–230

Junghans, H.: **Temperaturmessungen aus einem Frostloch des Tharandter Waldes,** [Temperature measurements in a frost hole in the Tharandter Forest], p. 230–234

Dieterichs, Heinz: **Regionale Unterschiede der Verdunstungskraft in El Salvador,** [Regional differences in evaporation power in El Salvador], p. 234–241

Würfel, H.: **Zum Einfluss des Juli- und Januarklimas auf den Menschen,** [The influence of the climate in July and January on man], p. 241–248

Lippert, Eugen: **Meteorotrope Krankheitsbilder: Übersichtsreferat (4), Infektionskrankheiten,** [Meteorotropic syndromes: general review, Pt. 4, Infectious diseases], p. 248–252

Astrophysical Journal, Chicago, Vol. 130, No. 3, Nov. 1959

Struve, O. and Zebergs, V.: **The red satellite absorption spectrum of Beta Lyrae,** p. 817–823
Violett, T. and Rense, William A.: **Solar emission lines in the extreme ultraviolet,** p. 954–960
Billings, D. E.: **Distribution of matter with temperature in the emission corona,** p. 961–971
Dunn, Richard B.: **Solar limb darkening near λ6563 from 0.9 to 1.00R,** p. 972–984
Rogerson, John B., Jr.: **The solar limb intensity profile,** p. 985–990
Rogerson, John B., Jr.; Spitzer, Lyman, Jr. and Bahng, J. D.: **A high-dispersion photoelectric spectrophotometer,** p. 991–1002
Hawkins, G. S. and Howard, W. E.: **Decay of light from a meteor train,** p. 1003–1007

Vol. 131, No. 1, Jan. 1960

Blackwell, D. E.; Ingham, M. F. and Rundle, H. N.: **The night-sky spectrum λλ5000–6500 Å,** p. 15–24
Halliday, Ian: **Auroral green line in meter wakes,** p. 25–33
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Edmonds, Frank N., Jr.: **On solar granulation,** p. 57–60
Boischot, A.; Lee, R. H. and Warwick, J. W.: **Low-frequency solar bursts and noise storms,** p. 61–67
Pottasch, S. R.: **Use of the equation of hydrostatic equilibrium in determining the temperature distribution in the outer solar atmosphere,** p. 68–74

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Wilson, B. G.; Rose, D. C. and Pomerantz, Martin A.: **The unusual cosmic ray events of July 17–18, 1959,** p. 328–331
Bailey, Dana K. and Pomerantz, Martin A.: **The cosmic ray increase of July 17, 1959,** p. 332–33

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McNamara, A. G.: **An analysis of some statistical properties of auroral radar reflections and their relationships to the detection capabilities of the radar,** p. 425–438
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Ciel et Terre, Brussels, Vol. 75, No. (7/8), July/Aug. 1959

Marussi, A.: **Les résultats des recherches géophysiques de l'expédition italienne au Karakoroum 1954–1955,** [Results of the geophysical research of the Italian expedition in the Karakoram, 1954–1955], p. 237–245
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Dufour, Louis: **Les écrivains et la météorologie: Saint-Exupéry,** [Writers and meteorology: Saint-Exupéry], p. 295–297

sti NSV Teaduste Akadeemia. Füüsika ja Astronoomia Instituut, Trudy Soveshchaniia po Serebristym Oblakam, Tartu, 12–14 Dekabria 1958 g. [Transactions of the Conference on Noctilucent Clouds, Tartu, Dec. 12–14, 1958.] Issued Tartu, 1959

Sharanov, V. V.: **Itogi Mezhdunarodnogo simpoziuma po serebristym oblakam,** [Results of the International Symposium on Noctilucent Clouds], p. 7–22

Dirikis, M.: **Itogi Rizhskogo otdeleniia VAGO po nabliudeniiu serebristykh oblakov v 1958 godu,** [Results of noctilucent cloud observations made in 1958 by the Riga Branch of the All Union Astronomical-Geodetic Society], p. 23–34

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Demidovich, E. G.; Kulagin, S. G. and Kovbasiuk, L. D.: **Nabliudeniia serebristykh oblakov v Gor'kom v 1957–1958 gg.,** [Observations of noctilucent clouds at Gorki in 1957–1958], p. 52–55

Skul'skiĭ, V. Iu.: **Nabliudeniia za serebristymi oblakami na Urale v period Mezhdunarodnogo geofizicheskogo goda,** [Observations of noctilucent clouds in the Urals during the IGY, p. 56–67

Grishin, N. I.: **Organizatsiia issledovaniĭ serebristykh oblakov v Mezhdunarodnom geofizicheskom godu,** [Organization of observations of noctilucent clouds during the International Geophysical Year], p. 68–76

Vasil'ev, O. B.: **Opyt fotometricheskikh nabliudeniĭ serebristykh oblakov v VAGO v techenie Mezhdunarodnogo geofizicheskogo goda (1957–1958 gg.),** [Photometric observations of noctilucent clouds by the All Union Astronomical-Geodetic Society during the International Geophysical Year, 1957/1958], p. 77–84

Khvostikov, I. A.: **Teplovoĭ rezhim atmosfery v zone serebristykh oblakov,** [Temperature regime of the atmosphere in the region of noctilucent clouds], p. 85–91

Burov, M. I.: **Fotogrammetricheskiĭ metod opredeleniia vysot serebristykh oblakov,** [Photogrammetric method of determining the height of noctilucent clouds], p. 92–111

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